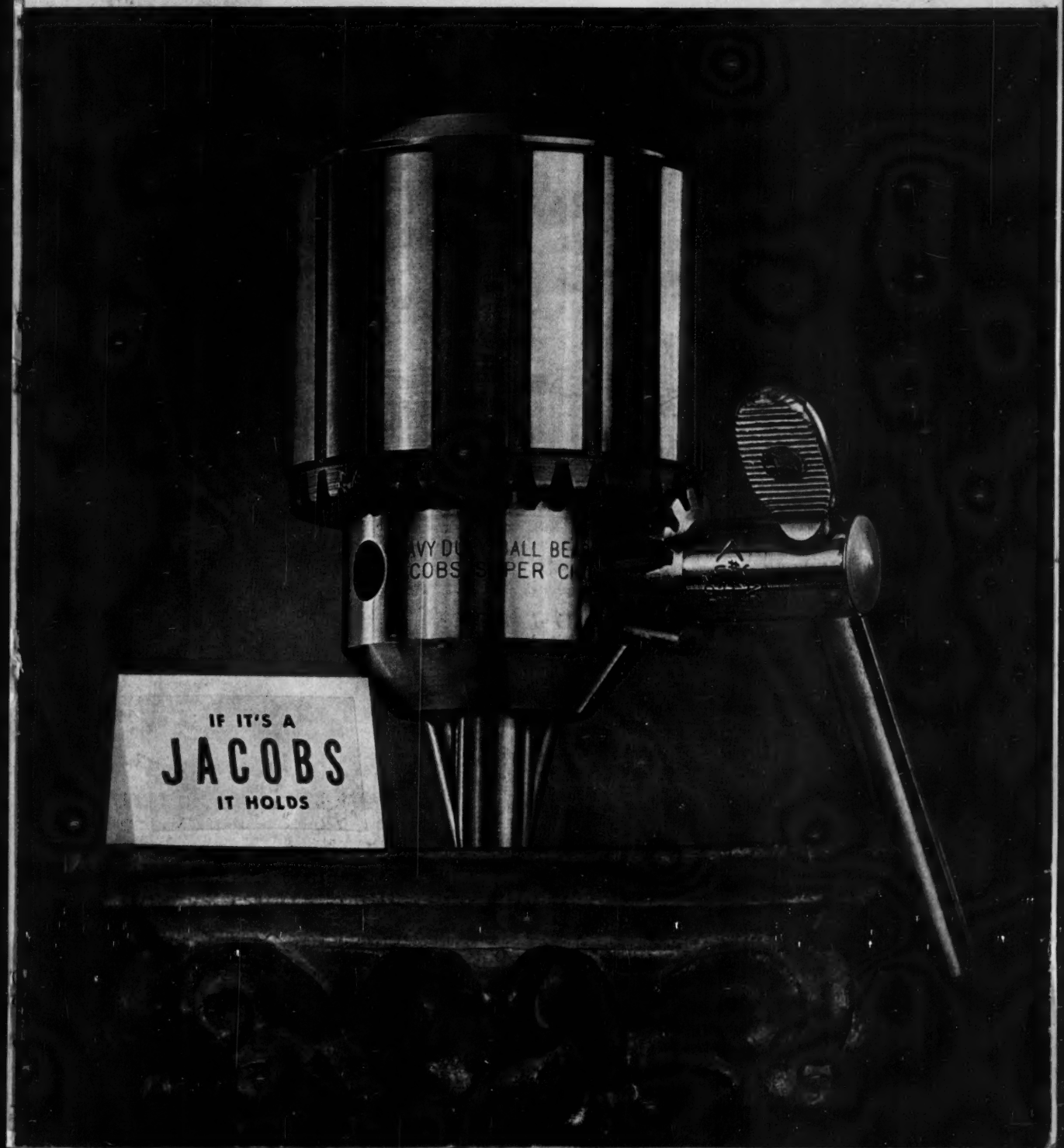
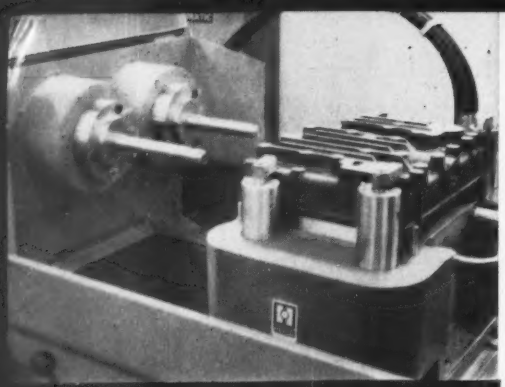
JUNE 1953 — FIFTY-NINTH YEAR

MACHINERY

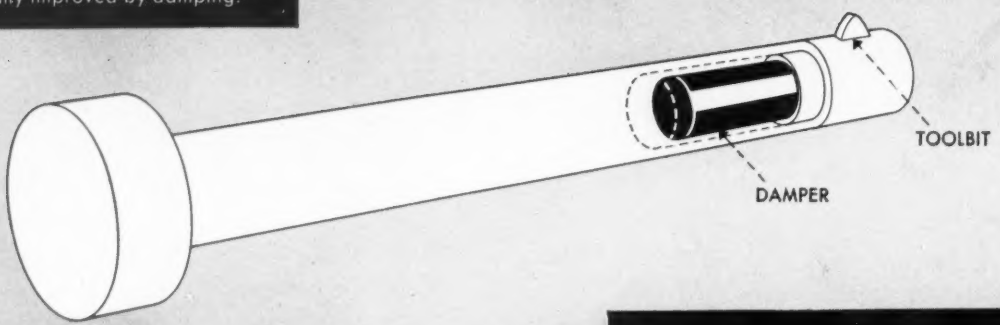




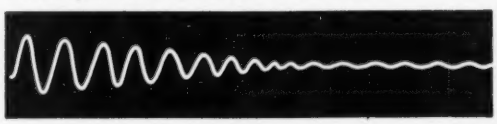
Long valve body holes are successfully bored, two at a time, with damped quills on this Heald Bore-Matic setup. Surface finish is materially improved by damping.

How Inertia Damping

PREVENTS QUILL CHATTER



Oscillograph record showing normal rapidity with which quill vibration tends to die out.



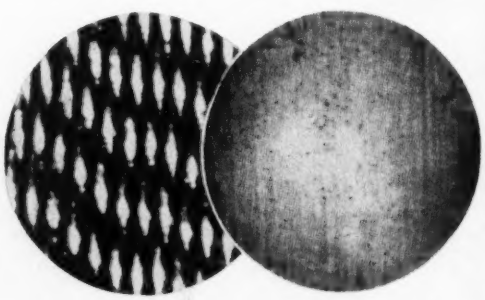
Oscillograph record showing how vibration in a properly damped quill decreases much more rapidly.

● Self-excited vibration in relatively long boring bars often presents a serious problem—particularly where a fine finish is required.

Heald's answer to this problem is the damped quill—a method of vibration control which has proved both simple and remarkably effective in a great many cases.

The damping effect is obtained by means of a plug of heavy material, inserted in the bored-out end of the quill. Being slightly smaller than the bore, the damper plug "floats" in its enclosure as the quill rotates, and its inertia tends to oppose or cushion any vibratory movement of the quill itself. The effectiveness of the damped quill is well illustrated by the microphotographs and oscillograph records shown at the right.

If you have a problem of self-excited quill chatter, ask your Heald representative for the complete damped quill story—or write for our special folder on damped quill applications. Remember—when it comes to precision finishing, it pays to come to Heald.



Above, at left, is a photograph, magnified 8 times, showing a chattered work surface before damping. At right, with same magnification, the surface finish has been obviously improved by damping the quill.

HEALD

Case Study
No. 2242-96 in
PRECISION PRODUCTION

INTERNAL AND ROTARY SURFACE GRINDING MACHINES AND BORE-MATICS

THE HEALD MACHINE COMPANY

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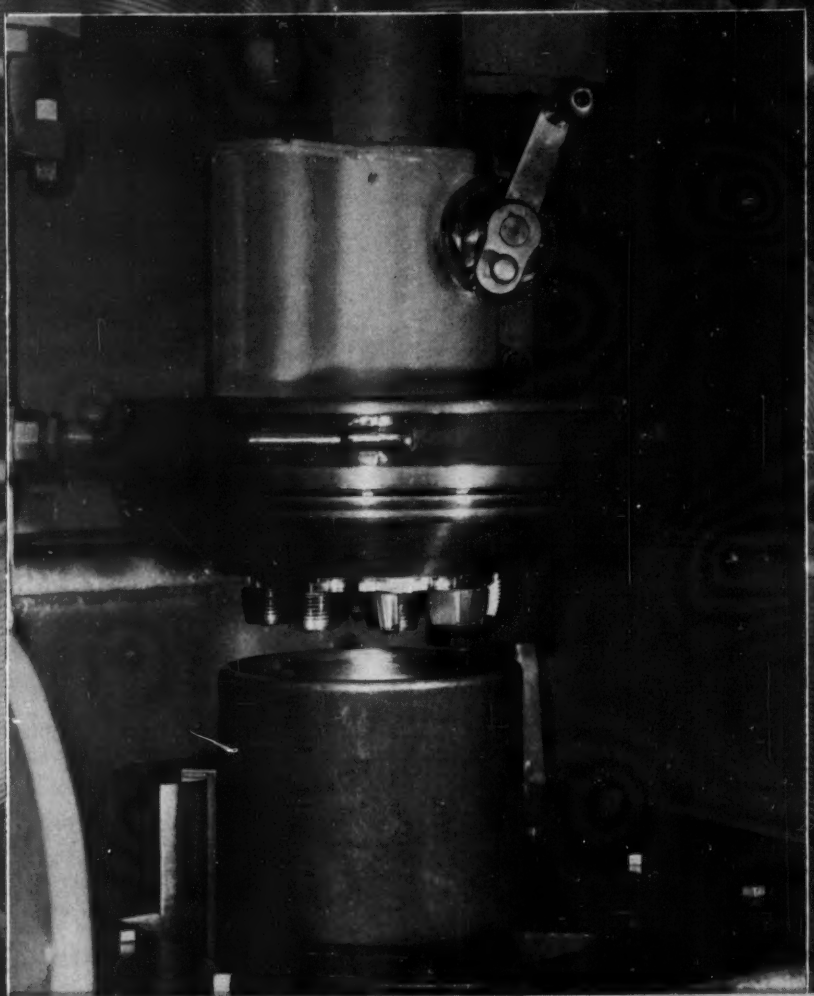
LARGE CASING



THE LANDIS Machine CO.

• • • THE WORLD'S LARGEST MANUFACTURERS OF

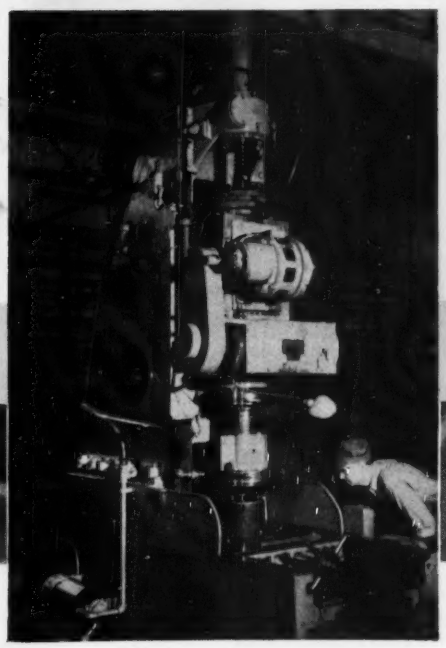
3740

THREADS TAPPED IN 12 MINUTES...

BAKER OIL TOOLS, INC., of Los Angeles, California, reports that a *LANDIS* CBLM Circular Chaser Tap mounted on a Stamet's vertical tapping machine has reduced threading time 75%, tapping 6⅝" to 13⅜" diameter threads in casing shoes.

Production examples illustrate the large savings made in threading time: (1) tapping 13⅜" N-80 tubular stock, oil well casing shoe with 8 Pitch API round threads 5" long requires but 12 minutes; (2) tapping a 6⅝" piece with an 8 pitch API round thread 5" long takes only 8 minutes. Formerly, threading a typical casing shoe would have required all of 40 minutes.

The *LANDIS* CBLM Tap, as used at Baker, is designed for use on production tapping machines to thread line pipe, casing, and drill pipe couplings. The tap head is detachable, and with the use of the various size tap heads available, the CBLM Tap will tap threads ranging from 4½" to 13⅜" O.D. It will cut either 3/16", ⅜", or ¾" tapered threads well within all API Standards, and can also be arranged for straight threading. Infinite taper adjustments are possible either above or below the required degree of taper to assure precision accuracy.



LANDIS manufactures a wide variety of taps for the economical production of internal threads ranging from 1¼" to 13⅜", either straight or tapered threads, on both stationary and rotating spindle machines. To ensure complete information, please enclose specifications when writing.

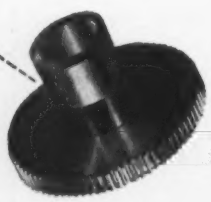
50TH ANNIVERSARY 50

LANDIS WAYNESBORO PENNSYLVANIA

THREAD GENERATING EQUIPMENT

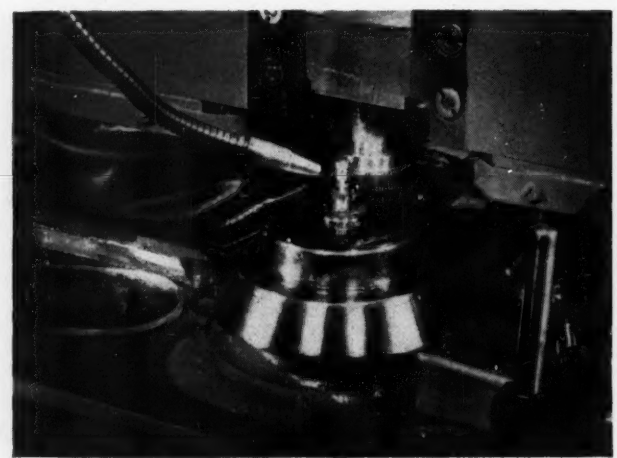
Direct Hits take Fellows-Cut

ACTUAL SIZE



SPECIFICATIONS

Material	Corrosion Resistant Steel 416
Outside Diameter	1.2812 + .000 —.001
Pitch Diameter	1.2500 + .0000 —.0005
Concentricity T.I.R.	.0004"
Diametral Pitch	64
Pressure Angle	14½°
Number of Teeth	80
Face Width	3/16"



FELLOWS CUT...by nine 3" Gear Shapers

Fellows

The FELLOWS METHOD ...in action!

Instrument Gears by the TON

A typical one of Arma Corporation's automatic aiming mechanisms has some 3,500 gears working in combination. These gears deliver motion only. Excessive pitch line run-out must be avoided or hits become misses.

a fair question

What is the quickest and most economical way to mass produce this accuracy?

Arma has picked the Fellows Method time and time again. Here are 4 reasons why:

Accuracy—scores of manufacturers in their own field could readily testify to mass production within unusually close tolerances with Fellows equipment.

Speed—a typical gear, specified at left, was cut, shaved and inspected in 4 minutes, 40 seconds.

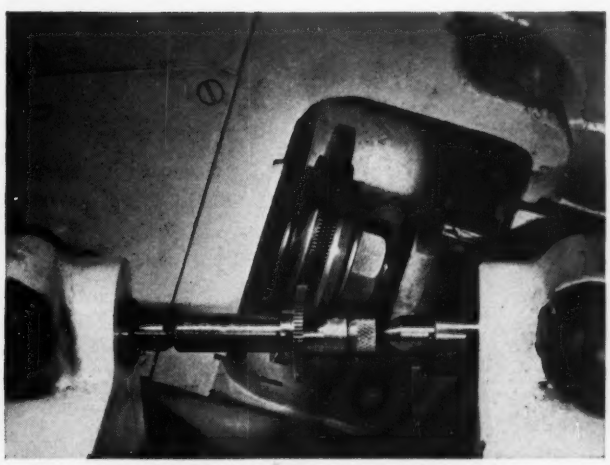
Versatility—the Fellows 3" Gear Shaper cuts gears from 1/16 inch pitch diameter to 3 inch pitch diameter.

Economy—one man runs 3 machines. Easily accessible fixtures cut change-over time.

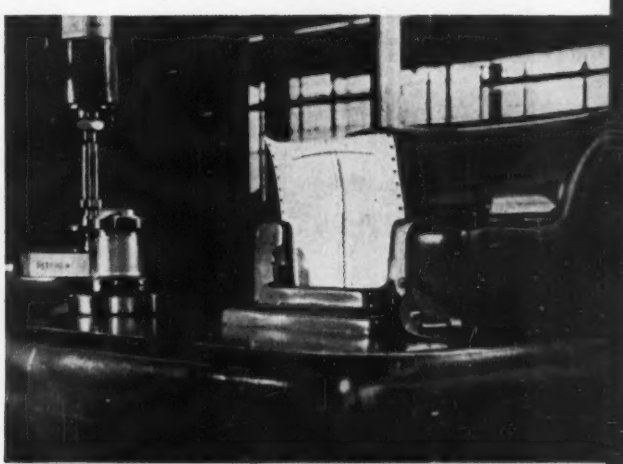
This is the Fellows Method in action. We would welcome an opportunity to discuss your gearing problems at your convenience.

PRODUCTION DATA

Cutting—	2 Cut Cam .005 Finish Cut	
	Type of Operation	Preshave
	Feed per stroke of cutter	.0045"
	Strokes per minute	700
	Cutting time	**3.5 minutes**
Shaving—	2 Cycle Cam	
	Shaving tool dia.	3.5"
	Shaving tool helix angle	18°
	Shaving tool R.P.M.	252
	Surface speed F.P.M.	231
	Shaving time	**40 seconds**



FELLOWS SHAVED...by eight #4 Gear Shavers



FELLOWS CHECKED...by four 8M Red Liners

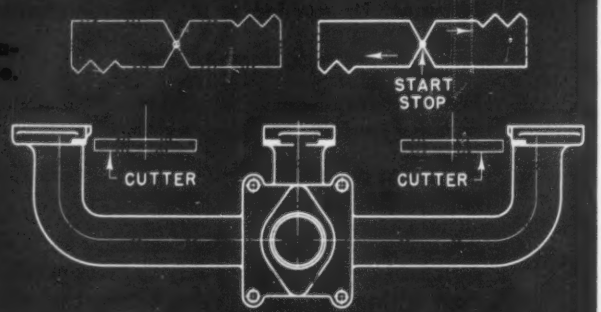
GEAR SHAPER COMPANY

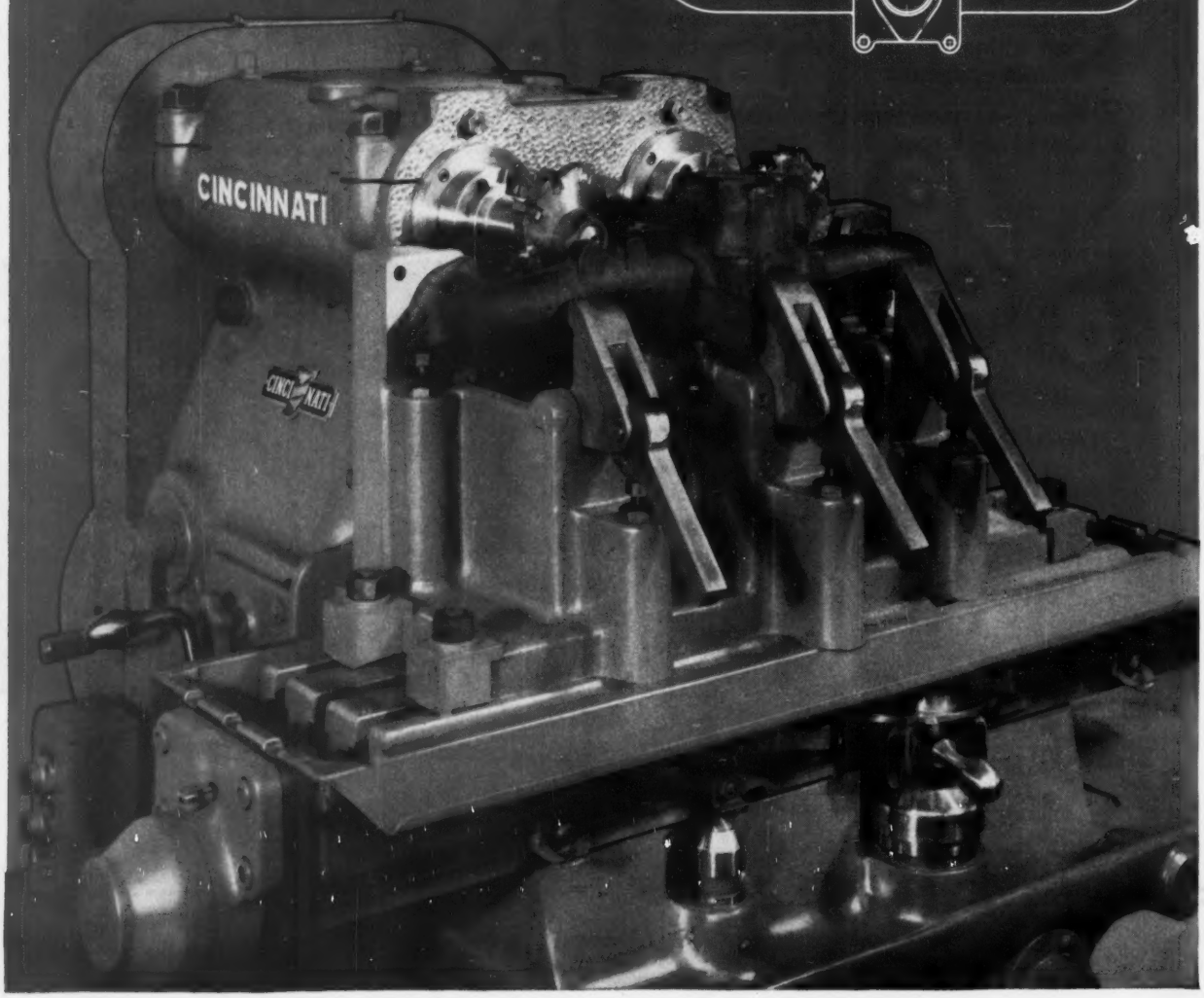
Head Office & Export Department: 78 River Street, Springfield, Vermont.
Branch Offices: 323 Fisher Building, Detroit 2 • 5835 West North Ave., Chicago 39
2206 Empire State Building, New York 1.

Replacing the overarm with a two-spindle head

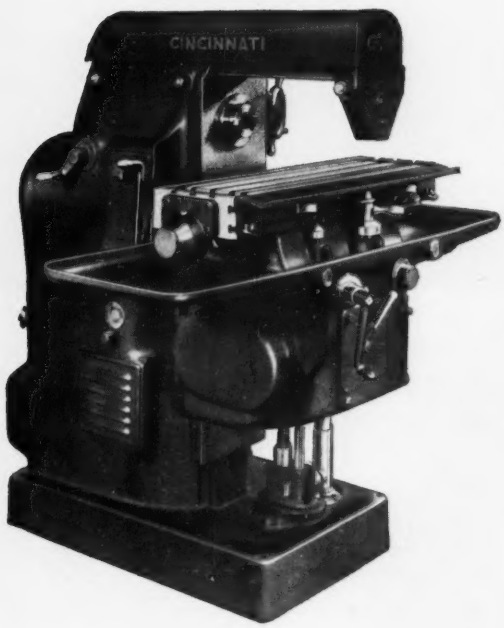
REDUCES COST OF MILLING

Drawing of part and diagram of automatic cycle.





OPERATION ON MANIFOLD



CINCINNATI *No. 1-18 Plain Automatic Milling Machine Catalog No. M-1555-2 containing complete specifications will be sent on request.*

production data

Part name	Intake manifold
Material	Cast iron
Operation	Mill flanges for stud washers
Depth of cut	⅛"
Cutters	4½" diameter, inserted blade, sintered carbide
Production	125 per hour
Machine	CINCINNATI No. 1-18 Plain Automatic Milling Machine

Multiple spindle milling machines usually save time by milling two or more parts simultaneously. In this example, however, only one part is milled at a time, but there are four surfaces and they are milled in pairs.

¶ Cincinnati Application Engineers assigned the job to a CINCINNATI No. 1-18 Plain Automatic Milling Machine so they could employ its automatic reciprocating cycle with a center safety stop position.

A two-spindle head, driven by the machine, is mounted in the overarm dovetail bearing at the top of the column. A manually operated fixture and two 4½" diameter sintered carbide cutters complete the equipment. This machine, with very little tooling, mills the flanges on manifolds at the rate of 125 per hour.

¶ CINCINNATI No. 1-18 Plain Automatic Milling Machines offer several advantages for work of this type:

(a) Automatic backlash eliminator for down-milling operations, or alternately up and down milling.

(b) Automatic spindle stop protects the operator.

(c) Fast automatic table cycles, with 300" per min. rapid traverse.

Other advantages for production milling operations within a 3 hp range are outlined in Sweet's Catalog File for Mechanical Industries. Complete data may be obtained by writing for catalog No. M-1555-2.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

Announcing

THE NEW

VAN NORMAN

DIVERSIMATIC

CENTERLESS GRINDING MACHINE

. . . another addition

The new Van Norman *Diversimatic* centerless grinding machine incorporates many outstanding, exclusive advantages that result in more work output per operator, per work shift.

This rugged, precision-built, heavy-duty centerless grinder enables you to perform three centerless grinding jobs with practically no change-over time. It's a standard centerless grinder for ordinary throughfeed work . . . a standard grinder for infeed jobs . . . and equipped with a Crush Forming attachment, it form grinds and does profile work.

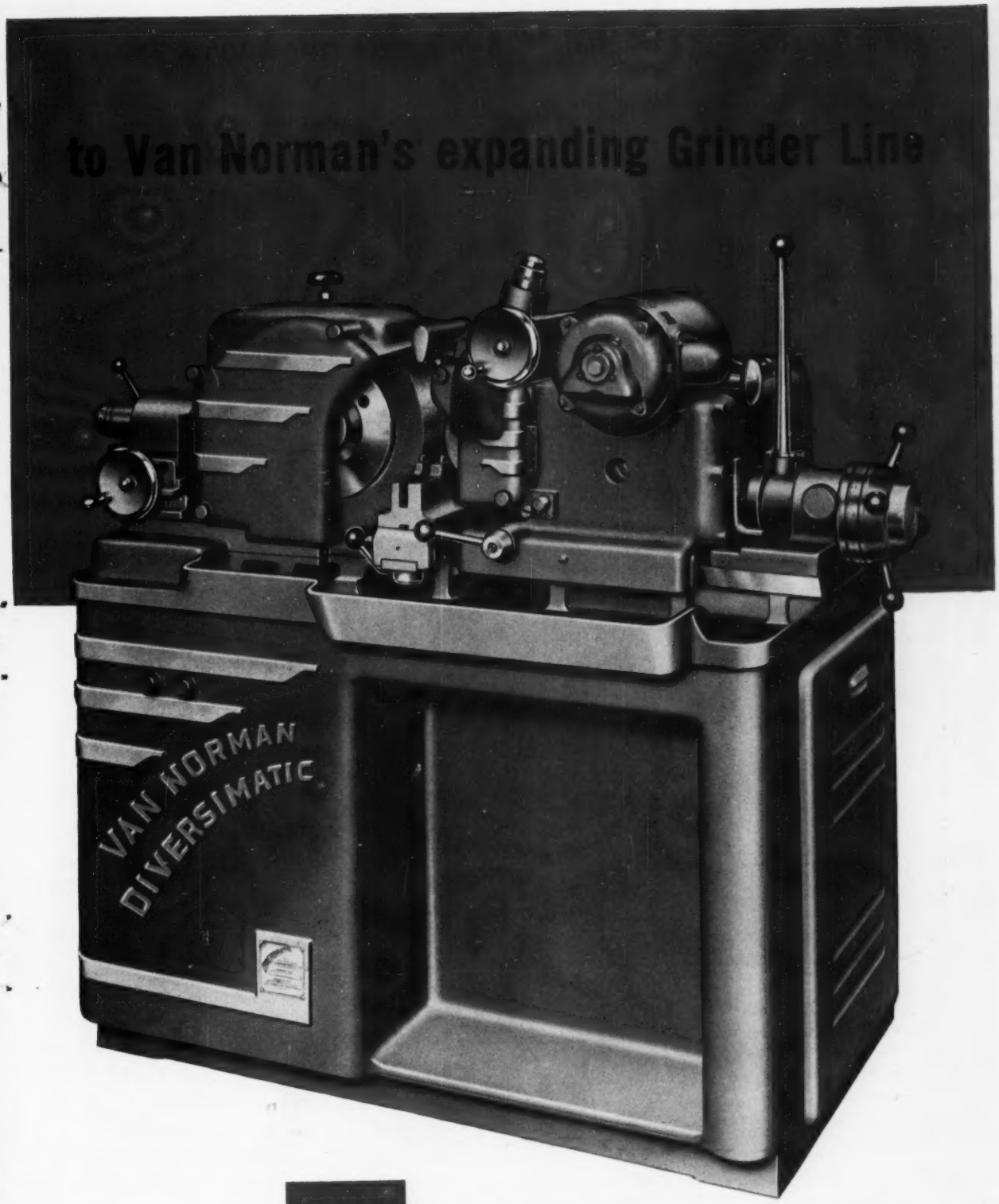
COMPARE THESE OUTSTANDING VAN NORMAN DIVERSIMATIC FEATURES

- Special, easily removable grinding wheel, spindle quill, with combined double-row super precision ball and roller bearings, sealed and lubricated for life assure trouble-free operation
- Spindle requires no warm-up period
- Combination straight and contour grinding wheel dresser.
- Straight screw-type regulating wheel dresser
- Grinding wheel diamond constantly flushed from below with coolant during wheel dressing
- Infinitely variable ¼ h.p. regulating wheel drive, 30 to 300 r.p.m.
- Large 1⅛ inch 4 thd. Acme Infeed Screw with full length split type nut to compensate for wear
- Work-Rest adjustable for position; may be fixed across the ways or made to feed in and out with the regulating wheel

Get the full facts on the Van Norman Diversimatic Centerless Grinder. See for yourself how this versatile grinder can cut your grinding costs on small shafts, formed shapes, parts of two or more diameters or special contours.

*Van Norman Diversimatic acquired from Diversified Metal Products Co.

to Van Norman's expanding Grinder Line

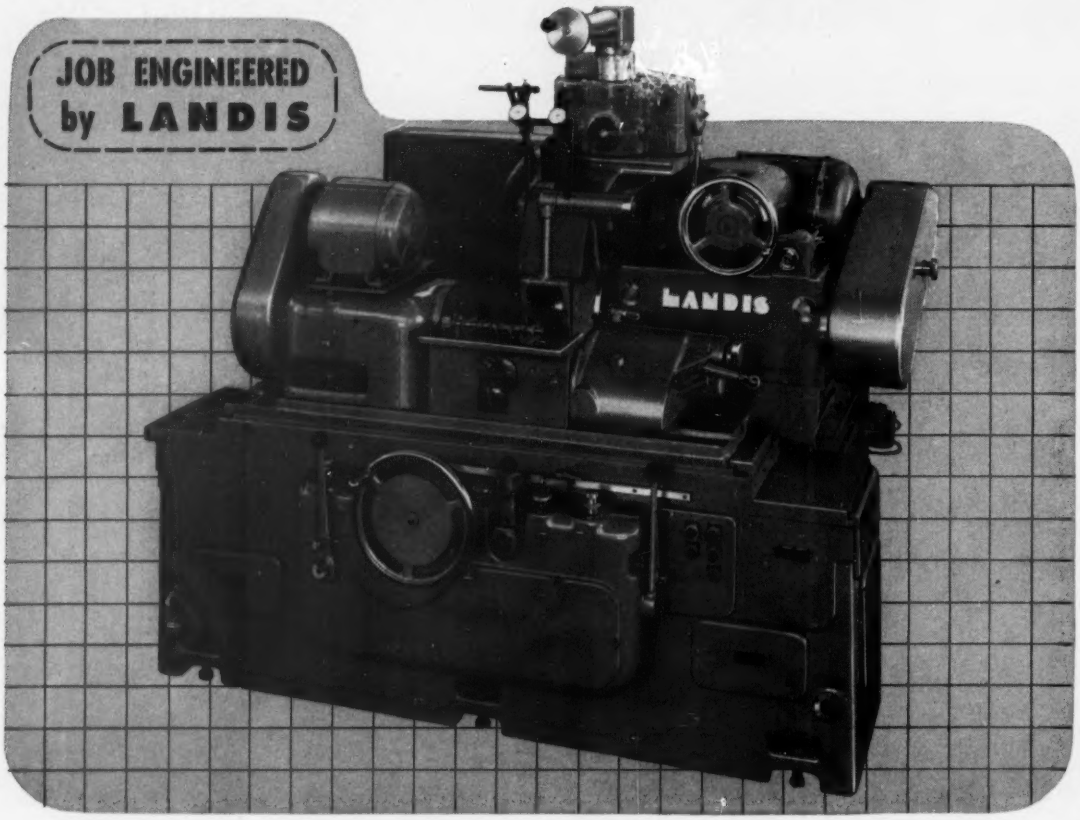


VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS, U. S. A.

How LANDIS JOB ENGINEERING cuts grinding costs...

Plain Grinder with Spaced Wheels Can Do Work of Two or More Machines



Landis 10" x 18" Type CH Plain Grinder with spaced grinding wheels and hydraulically operated, wheelbase mounted overhead dresser.

JOB ENGINEERED by LANDIS means ideas that will produce the highest return on your investment. It starts with operator convenience, hydraulic controls and simplified maintenance of a *standard* grinder. Then, on the basis of your requirements of finish, tolerance and production, we apply tooling, such as spaced wheels, to increase production and accuracy.

Landis Grinders are engineered to *your* specific requirements. They give you the fastest return on your investment. Send us your prints for tooling and production estimates. Landis Tool Co., Waynesboro, Pennsylvania, U.S.A.

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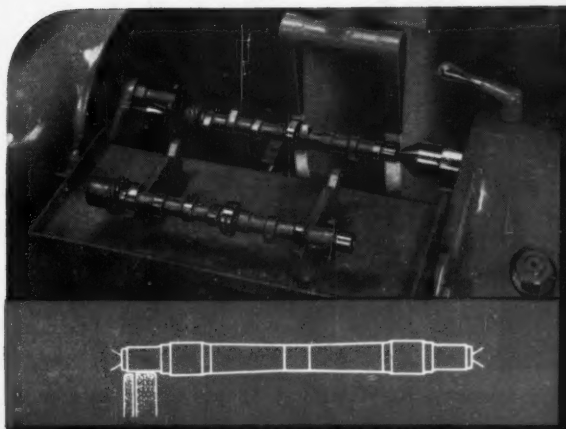
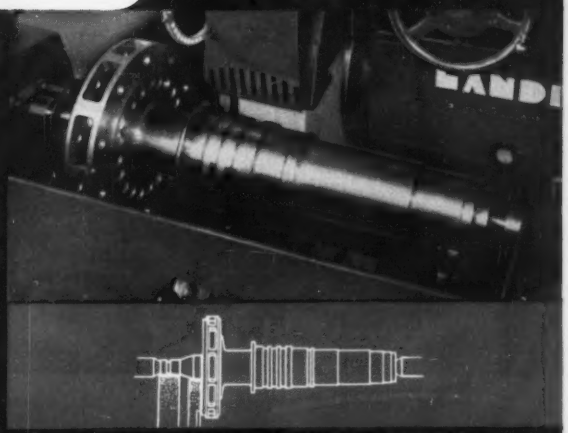
LANDIS

precision grinders

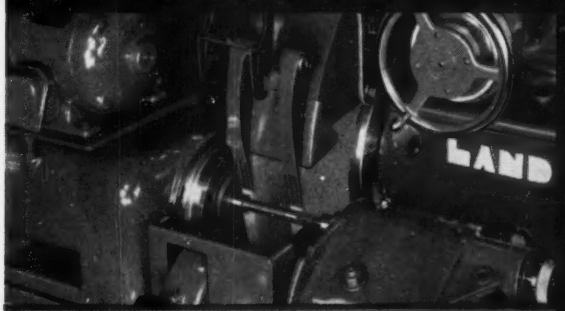
JOB ENGINEERED
by LANDIS

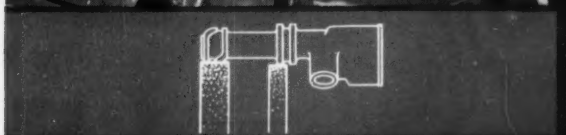


CENTER AND END BEARINGS OF CAMSHAFT
GROUND IN ONE OPERATION

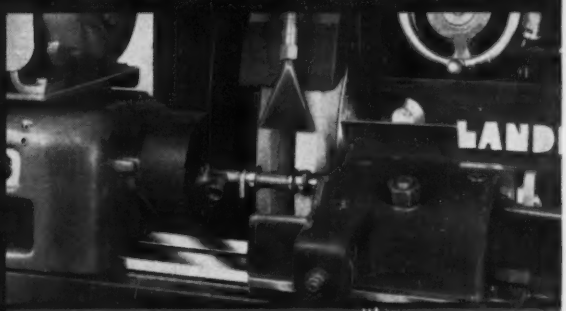


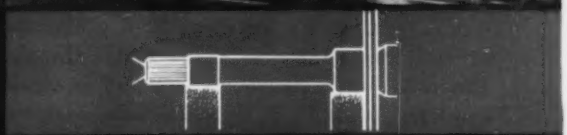
GRINDING VARIOUS DIAMETERS OF PROPELLER
SHAFT WITH SPACED WHEELS AND SPECIAL FEED



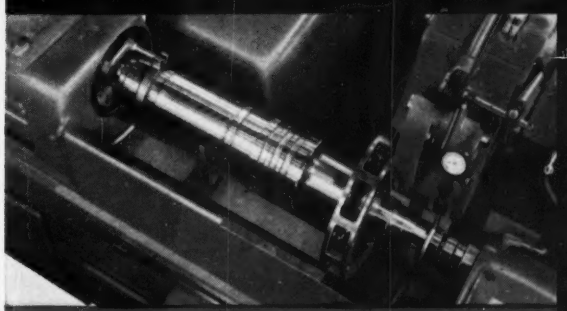


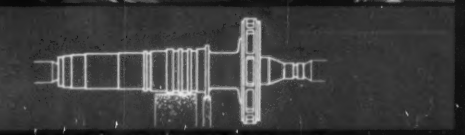
TWO DIAMETERS OF INPUT SHAFT
GROUND SIMULTANEOUSLY



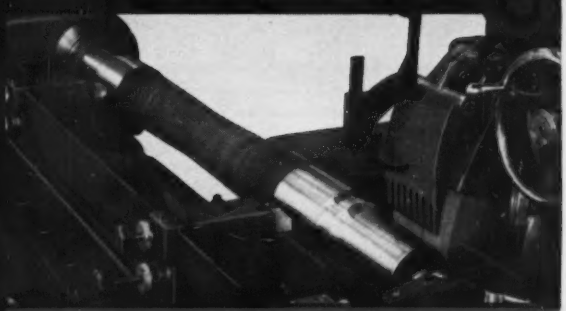


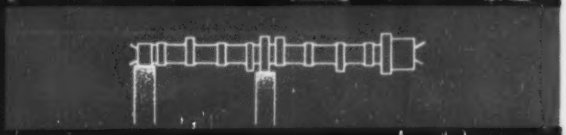
OIL PUMP BODY DIAMETERS GROUND WITH
TWO WHEELS OF DIFFERENT GRADES





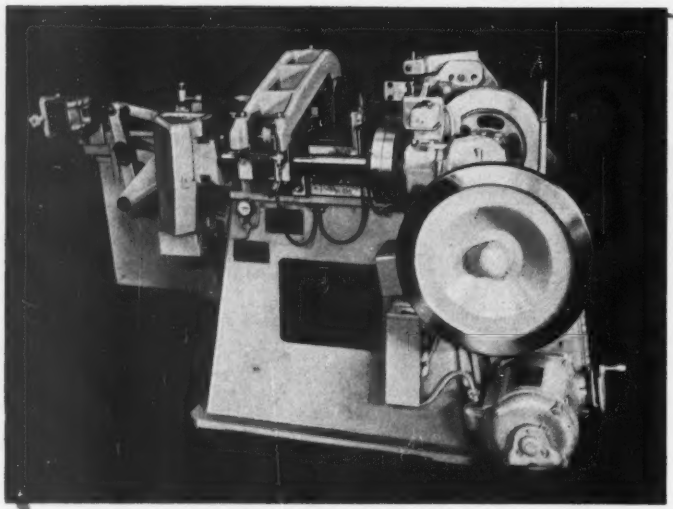
END DIAMETERS OF PROPELLER SHAFT
GROUND IN ONE OPERATION





SPACED WHEELS WITH RADIUS ON CORNERS
FOR GRINDING RAILROAD CAR AXLES

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA, U. S. A.



ON THIS TOP QUALITY

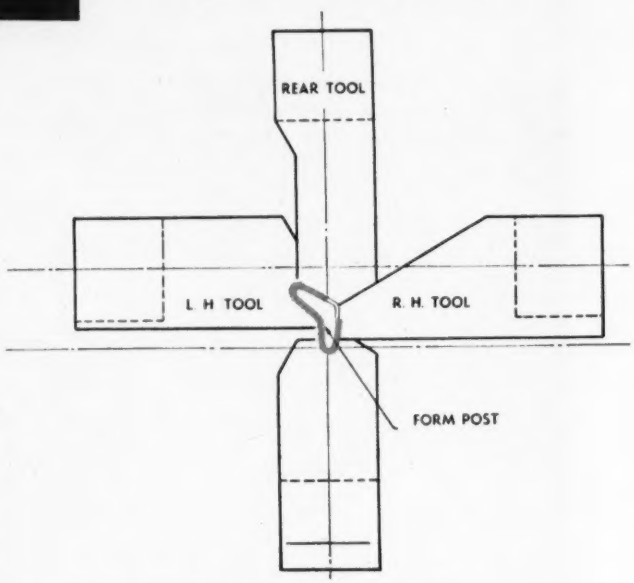
No. 28 U.S. PAYS FOR

No. 28 U. S. Multi-Slide. Stock capacity, 1½" wide; feed length, 8". Overall size, 40" x 50" x 80". Weight, 2600 lbs.

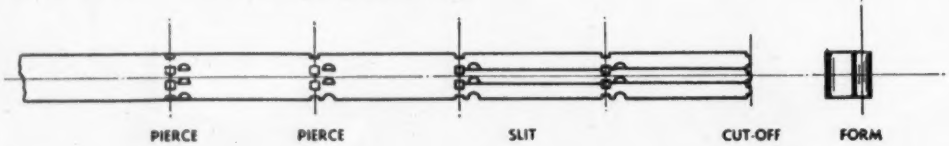
DRAWING AND PHOTO ILLUSTRATE VERSATILITY OF U. S. MULTI-SLIDE

600 Parts per Minute!

The part illustrated below is produced in a No. 28 U. S. Multi-Slide from .016" phosphor bronze, and the sequence of tooling is indicated in the drawings. The finished part is 3/16" wide and the material fed into the machine is 9/16" wide. The 9/16" material is sheared in the Multi-Slide into three strips, from each of which one part is produced. The Multi-Slide runs at 200 strokes per minute, resulting in a production of 600 finished pieces per minute. *On this particular job, our customer wrote off an investment for a No. 28 U. S. Multi-Slide, complete with tools, in 11 weeks!* Possibly you have similar jobs in your plant where the use of the U. S. Multi-Slide will result in equivalent savings.



TOP VIEW OF FORMING POSITION



US PRODUCTS

U.S. TOOL

HIGH-PRODUCTION JOB . . .

MULTI-SLIDE® ITSELF IN 11 WEEKS!

The design of many metal stampings is such that they are particularly adaptable for production in multiples (2, 3, or even 4 at a time) in the U. S. Multi-Slide, resulting in savings in material and increased production. The illustrations at the right and the job on the opposite page show just a few of the many different types of parts which can be produced in this manner. In all cases, the width of the material which is fed into the U. S. Multi-Slide Machine is an exact multiple of the width required for one part. The material is sheared in the machine into 2, 3, or 4 individual strips (depending on the design of the part) and one piece is produced from each strip at each stroke of the machine. On this type of operation the machine is arranged with a Positive Rear Knockout that maintains the individual strips in line after shearing, and prevents interference during the feed stroke.

Bulletin No. 15-M contains complete specifications of four sizes of U. S. Multi-Slides. Write for your copy—there's no obligation.

Produced on a No. 28 Machine. 125 strokes per min., 3 at each stroke. Total 375 pieces per minute.

Produced on a No. 33 Machine. 125 strokes per min., 3 at each stroke. Total 375 pieces per minute.

Produced on a No. 33 Machine. 125 strokes per min., 3 at each stroke. Total 375 pieces per minute.

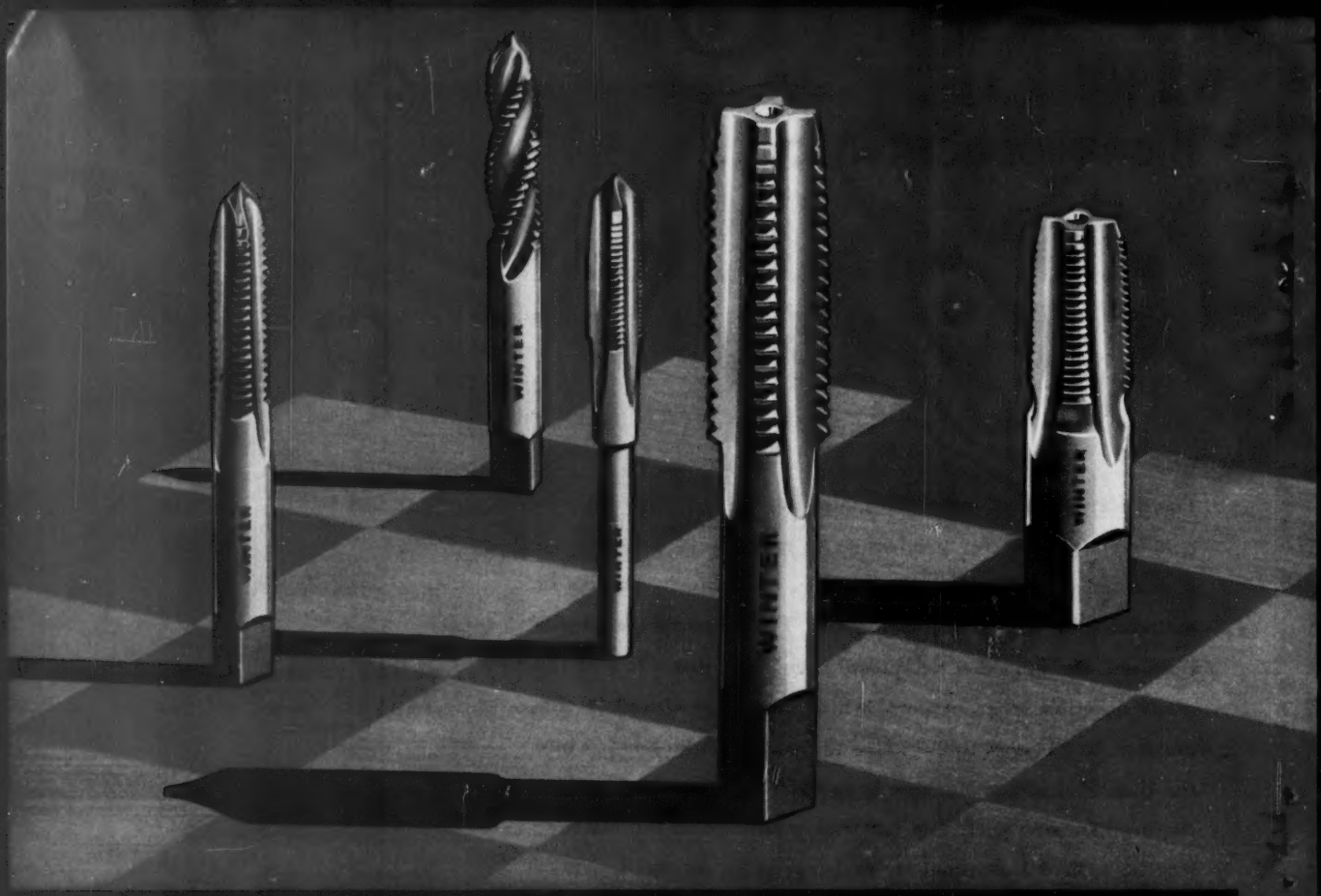
Produced on a No. 33 Machine. 125 strokes per min., 3 at each stroke. Total 375 pieces per minute.

®Trade Mark Registered—U. S. Patent Office

COMPANY, Inc. AMPERE (East Orange) NEW JERSEY

Builders of U S Multi-Slides–U S Multi-Millers

U S Automatic Press Room Equipment–U S Die Sets and Accessories



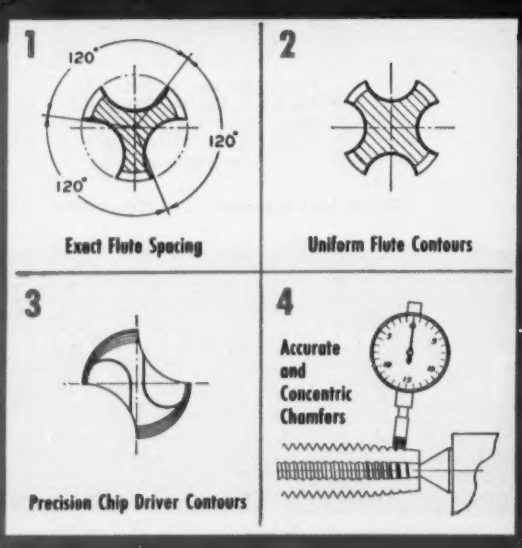
Get These 4 Advantages of

BALANCED Action

BALANCED ACTION results in tapped holes of uniform and accurate sizes; minimum scrap losses; and money saved through longer tool life.

ALWAYS AT YOUR SERVICE

Your local Industrial Supply Distributor carries a complete stock of WINTER Taps.



WINTER

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A. [illegible]

Division of National Twist Drill & Tool Co.

Get the edge . . .

Buy National milling cutters with their dependable cutting edges. Let National specify a design exactly suited to the work they must do . . . You'll get the edge in peak production, smooth operation, and long wear.

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities

Factory Branches: New York, Detroit, Chicago, Dallas, San Francisco

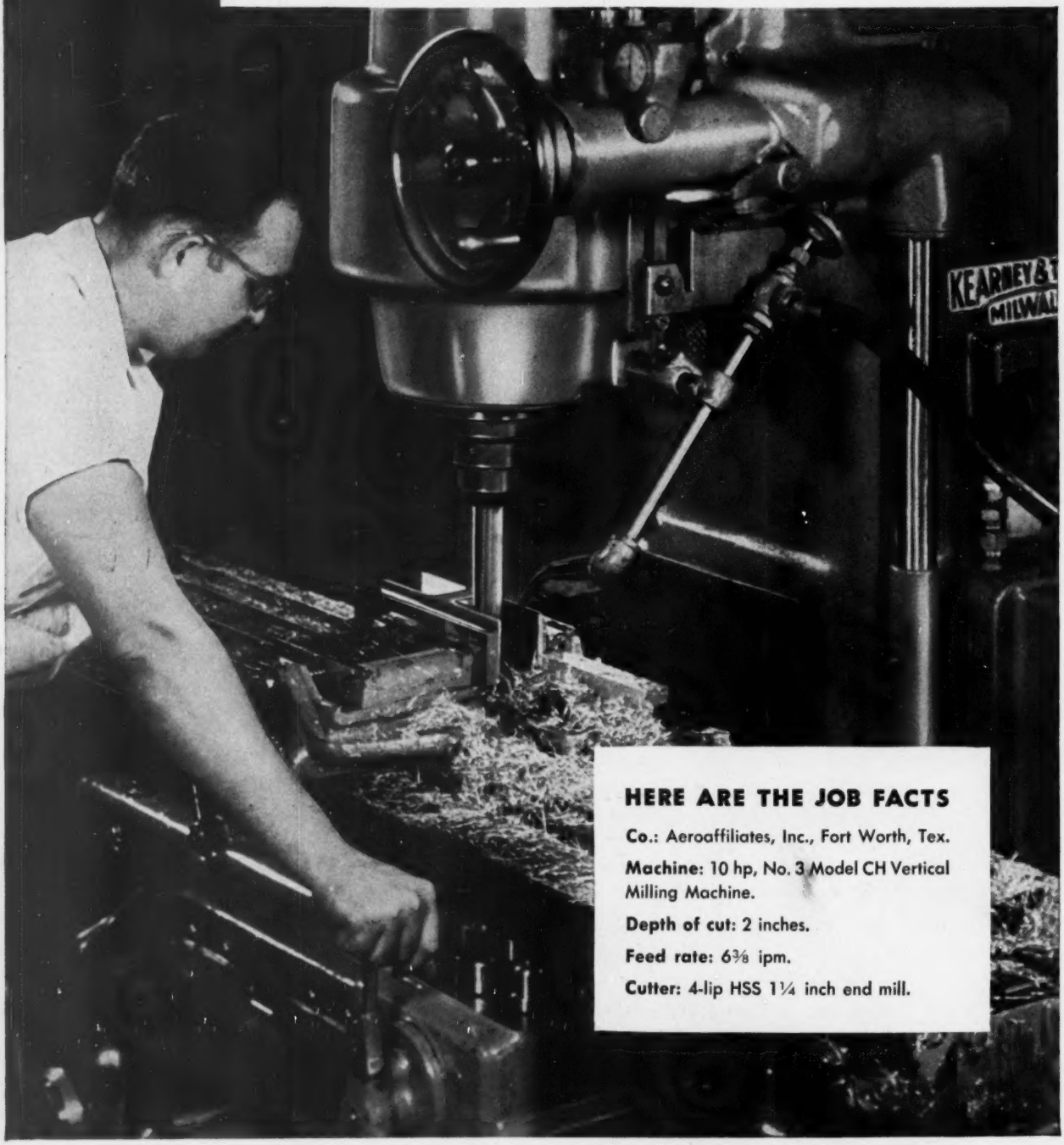
CALL YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

. . . for all your staple industrial needs, including NATIONAL Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs, and Special Tools.

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH., U.S.A.

National

Load, engage feed there is to it with



HERE ARE THE JOB FACTS

Co.: Aeroaffiliates, Inc., Fort Worth, Tex.

Machine: 10 hp, No. 3 Model CH Vertical Milling Machine.

Depth of cut: 2 inches.

Feed rate: 6⅜ ipm.

Cutter: 4-lip HSS 1¼ inch end mill.

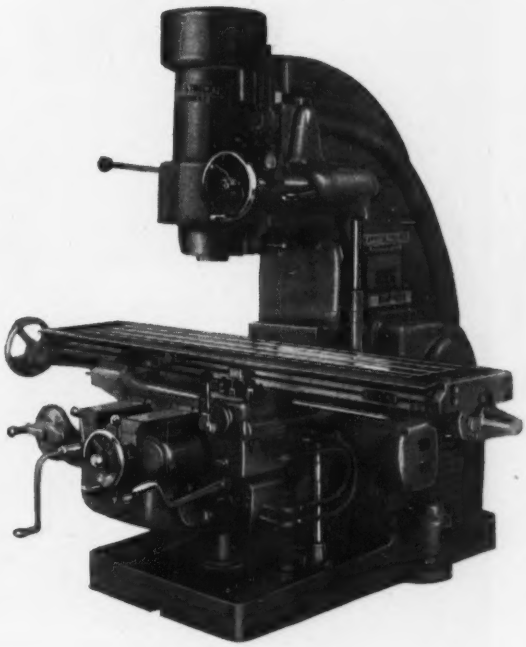
and unload—that's all this CH miller!

Aeroaffiliates of Texas select Kearney & Trecker's 10 hp No. 3 Model CH Vertical Milling Machine with *Mono-Lever and Automatic Cycle Table Control*, to speed up milling of aircraft parts and reduce operator fatigue!

TO finish-mill aluminum vertical beam fittings, this manufacturer put production on an almost automatic basis without sacrificing accuracy. He's handling the job on a 10 hp, No. 3 CH Vertical Milling Machine equipped with Mono-Lever and Automatic Cycle Table Control.

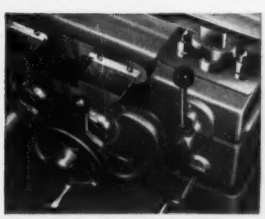
Now, after the original setup, all the operator does is load the machine, engage the feed and unload. Production is up, accuracy is maintained and operating conditions have been greatly improved to the reduction in operator fatigue.

Check this great CH line of machines for yourself. See how you, too, can cut costs, increase productivity, improve safety, get better finished products. Contact our representative or write Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

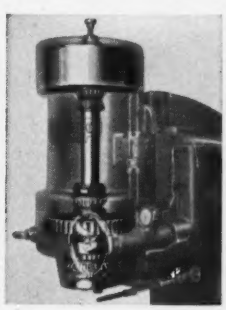


10 hp, No. 3 Model CH Vertical Milling Machine

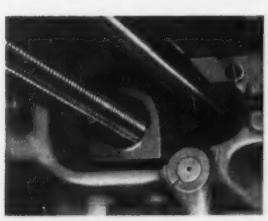
CH Milling Machine features that helped increase output — cut cost per piece



Greater Operating Convenience through Mono-Lever control facility (optional at extra cost) for table feed and rapid traverse. Also, rapid-set micrometer dials — with new vapor blasted, satin finish for greater legibility to avoid setting errors.



Greater Cutting Efficiency through spindle-mounted flywheel, (optional on CH Models) running with three bearing support. On this job it meant fast metal removal and an excellent finish.



Smoother Feed Performance through large dia. heavy-duty table feed screw that affords greater bearing contact, runs through extra-long table feed nut. All models are equipped with backlash eliminator for more effective climb milling, greater accuracy and longer screw life.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

HYPRO

Maestro...

with a 100 hp orchestra!

At this master machinist's finger-tips — the responsive power . . . the extreme precision, and the smooth, exact movement—that a G&L planer offers

Yes, superbly designed, craftsman-built G&L HYPRO Planers give you the capacity for simple or complex work . . . the versatility for economical handling of long production runs or short custom jobs.

More — they provide ample power to take optimum advantage of modern, high-speed cutting tools. And, like all G&L machines, HYPRO Planers are built to last . . . give you many years of original, hairline accuracy.

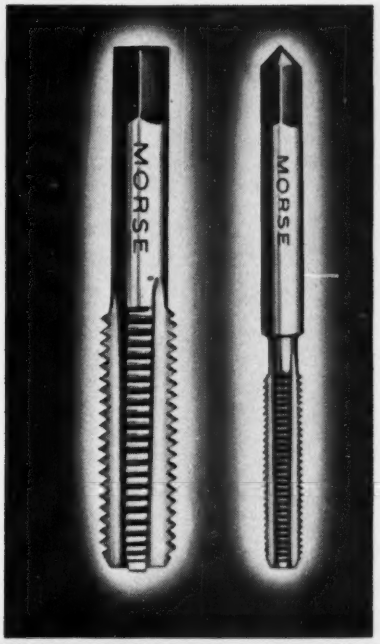
G&L HYPRO Double Housing Planers and Openside Planers are available in many models with working widths up to 144 inches . . . bed lengths to suit the model . . . up to 150 hp. For details see your G&L representative or write ———

GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal, Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

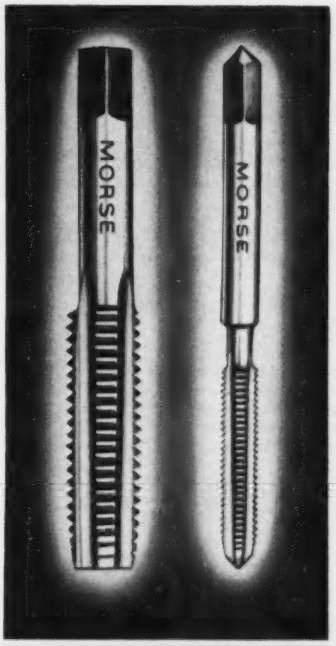
"We never knew what Special-Purpose Taps could do . . . 'til we got these NEW MORSE TAPS!"

MORSE



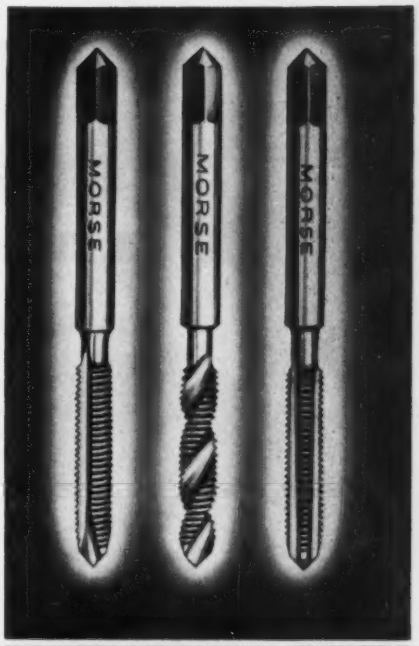
For Brass or Cast Iron

For use in these and other materials with *brittle-chip* characteristics . . . in hand, machine-screw, and taper-pipe styles. Made with radial face (0 degrees rake — see drawing at right below) and surface-treated to resist abrasion and loading. High-speed steel with commercial ground threads only, except for pipe taps (also furnished with cut threads.)



For Aluminum or Stainless Steel

For use in these and other materials with *stringy-chip* characteristics . . . in hand, machine-screw, and taper-pipe styles. Made with a 15-degree hook (see center drawing at right below) and commercial ground threads, in high-speed steel only.



Oversize Machine-Screw Taps

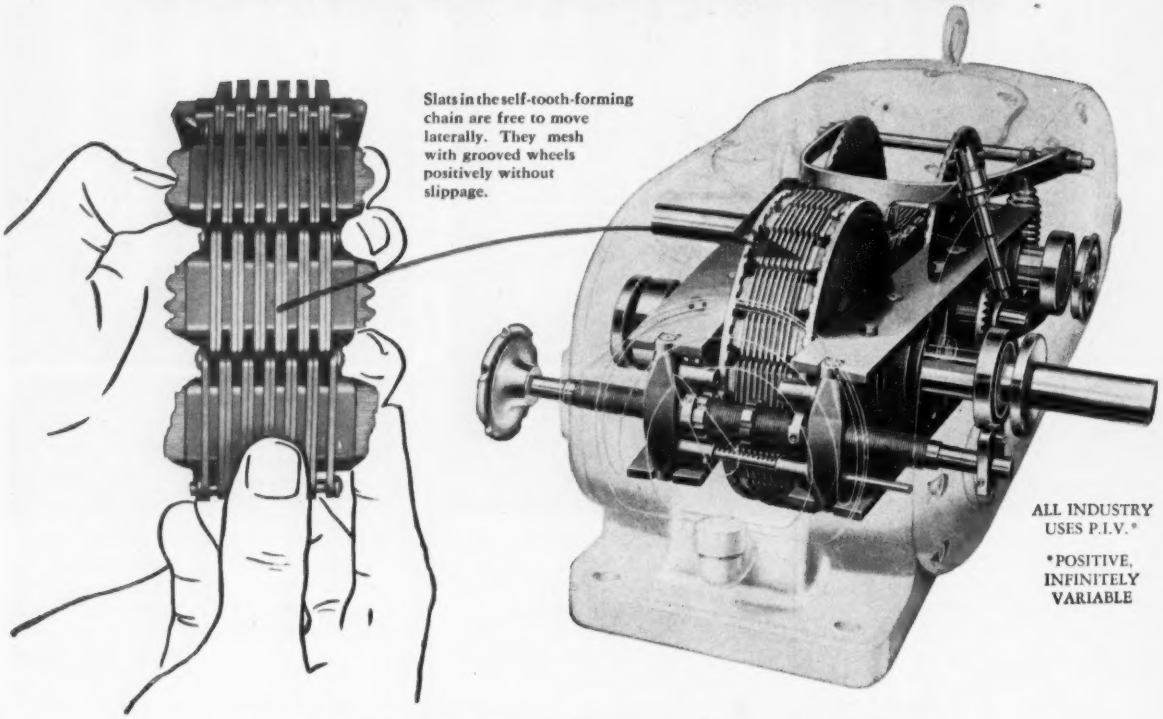
For use in materials like plastics or zinc alloys, *where difficult to maintain proper tapped-hole size* . . . because of the material's abrasive properties or its tendency to shrink, *after tapping*. Made in certain sizes only . . . in straight-flute . . . spiral point . . . and spiral flute styles. Regularly furnished .002" over standard commercial ground-thread limits. Surface-treated to resist abrasion.

HERE'S THE BIGGEST TAP NEWS IN YEARS . . . and as usual it comes from Morse. These new Special-Purpose Taps . . . set new standards of performance and long life. Get the whole story on this new Morse line *direct and in person* . . . from your experienced Morse-Franchised Distributor, who is always at your service. He has an important new free booklet for you . . . giving complete details on these new Morse Special-Purpose Taps, and full information on the new Unified Threads.

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Houston, San Francisco

Cutting Tools

Completely POSITIVE...
Completely STEPLESS
with an infinite number of speed changes



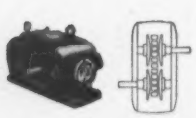
Slats in the self-tooth-forming chain are free to move laterally. They mesh with grooved wheels positively without slippage.

ALL INDUSTRY USES P.I.V.*

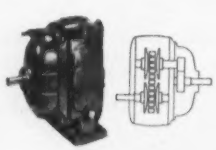
*POSITIVE, INFINITELY VARIABLE

P.I.V. Variable Speed Drive gives you exact selection from maximum to minimum speed

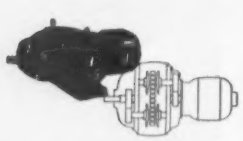
4 of 16 P.I.V types, ½ to 25 hp.—ratios to 6:1
Horizontal or Vertical Mountings



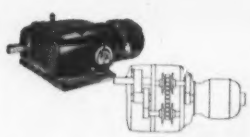
Basic Positive, Infinitely Variable Speed Drive. Compact.



P.I.V. with single reduction input or output helical gears.



Motorized P.I.V. with single reduction input and output helical gears.



Motorized P.I.V. with single reduction input and double reduction output helical gears.

ONLY Link-Belt's P.I.V. Variable Speed Drive uses self-tooth-forming chain to provide positive, stepless speed changing. The chain meshes with grooved wheels, transmits power without wasteful slip.

What's more, Link-Belt's P.I.V. changes speeds accurately under full load, delivers full-rated horsepower to your machines. That's because P.I.V. is not dependent on friction for power transmission. Its all-metal construction is not affected by atmospheric conditions.

Adjustment is easy. You can obtain an infinite number of speeds with manual, electric, pneumatic or hydraulic controls . . . hold the exact speed you need at any setting.

There may be a process in your plant that requires exact, variable speed transmission. If so, it will pay you to contact your nearest Link-Belt office. They'll show you how P.I.V. can increase the flexibility and efficiency of your machines. Send for Catalog No. 2274.

P.I.V. LINK-BELT VARIABLE SPEED DRIVE

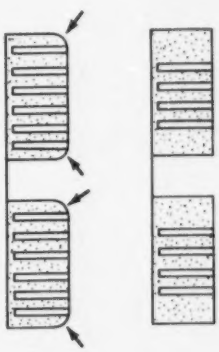
LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities. 13,118

Gardner Abrasive Engineering

How a change in design of disc surface improved accuracy and increased output

THE PROBLEM

Grinding the parallel ends of valve and clutch springs called for high accuracy and fast stock removal. An overall deep corrugated disc gave the desired speed of stock removal. However, the inner and outer edges wore down to cause periodic inaccuracies in work.



THE SOLUTION

Gardner engineers recommended a disc in which the deep corrugations were removed from the surfaces adjacent to the periphery and center hole. Results: A cutting face that did not round off and break down at the edges. Production increased because there were fewer rejects and less time needed for dressing.

Gardner Abrasive Engineering offers experience derived from making both the grinding machines and the abrasive discs. It considers machine performance first and then evaluates how grade and grain of abrasive affect grinding results. If standard abrasive discs won't do the job, discs are made *just for you.*

For help with your grinding problems, consult the Gardner Abrasive Engineer. 108A

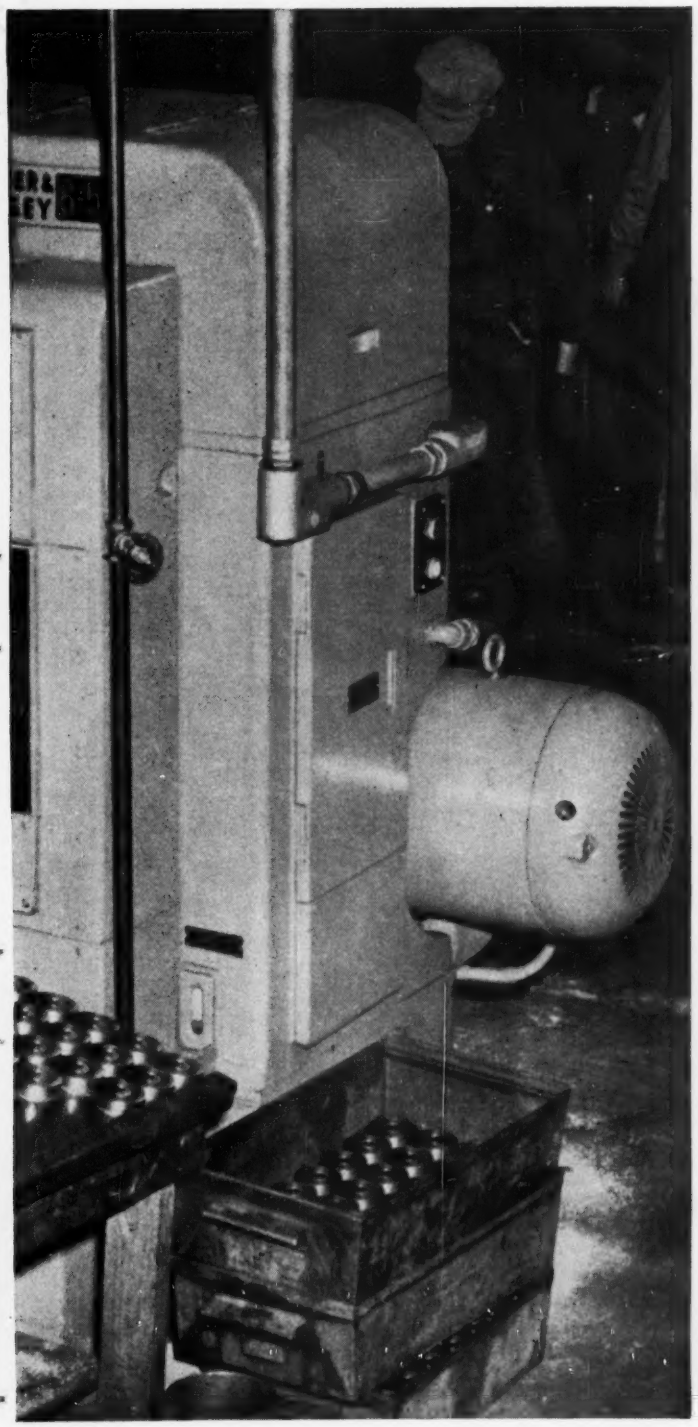
GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U.S.A.

GARDNER
abrasive discs

AUTOMATIC PAYS FOR ITSELF

YOU CAN PRODUCE IT BETTER, FASTER FOR LESS WITH WARNER & SWASEY

IN ONE YEAR'S OPERATION!



THIS STORY comes from the production-minded Eureka-Williams Corporation of Bloomington, Illinois. Shooting for greater production, they installed a Warner & Swasey 5-Spindle Automatic Chucking Machine to machine the cast iron valve discs used in their oil burners.

The first month's production records showed the machine had more than lived up to expectations. During the month, the machine turned out as many parts as seven hand-operated machines! And it reduced the machining cost on the parts 45%. Records for subsequent months showed even increased savings—and that the machine actually paid for itself in the first year's operation!

Eureka-Williams has found that the 5-Spindle Automatic is quick and easy to set up, that operators like the machine, that it has provided them the dependable, high precision operation you can expect from any Warner & Swasey.

Certain jobs in your shop—even small and medium lot runs—can undoubtedly be machined faster, more uniformly, and at lower cost on Warner & Swasey Automatics. Your nearest Warner & Swasey Field Representative will be glad to show you exactly how an automatic can improve *your* operations.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

Only CARBORUNDUM gives YOU

CARBO

TRADE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, New York

so wide a choice of abrasive tools

You get UNBIASED COUNSEL based on all abrasive methods

Your business, in mass production of parts or finished assemblies, is the problem of generating close tolerance sizes, of producing high surface finishes, of removing stock. The business of CARBORUNDUM is the exclusive ability to recommend and furnish you the specific type of abrasive product which will give you highest quality at lowest cost, on every operation you perform.

Take off-hand grinding, for instance. You can count at least 7 different abrasive methods of off-hand grinding. How can you be *sure* the method you are using is the best —the lowest in cost? By asking CARBORUNDUM . . . for CARBORUNDUM alone has a complete, branded line of grinding wheels *and* abrasive belts *and* tumbling and polishing grains. Only CARBORUNDUM can recommend without bias, on the sole basis of what's best for you.

Or suppose you manufacture fountain pens. You can finish and polish the barrels with abrasive belts or grinding wheels . . . you slit the points with a tiny grinding wheel . . . finish the clips with tumbling abrasives. CARBORUNDUM alone gives you *one-source control* of abrasive quality, on every type of abrasive you use . . . quality that's constant, identical, dependable—thus economical.

Several ways to do one operation? Call in CARBORUNDUM. Several processes on one part? Call in CARBORUNDUM. Either way, you win.

Call your CARBORUNDUM *Salesman or Distributor* today!

He's your best bet for complete stocks, prompt delivery . . . and best of all, experienced counsel on *every* new development in the *entire* field of abrasives. He's in the yellow pages under "Abrasives" or "Grinding Wheels." Phone him today—it's to your profit!

Ready now—your free copy of the new big COATED ABRASIVE SELECTOR catalog . . . containing detailed recommendations for both machine and hand sanding operations on tough and soft metals, glass, plastic, wood. Phone for it today.

RUNDUM

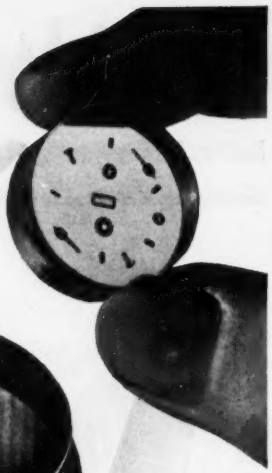
MARK

. . . the ONLY source for EVERY abrasive product you need

80-54

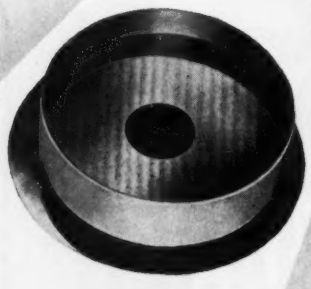
Tiny?

Yes! The No. 11 Blanchard Surface Grinder grinds these ladies' watch gears, pinions and ruby bearings flat and parallel, and to a dimension tolerance of .0002".



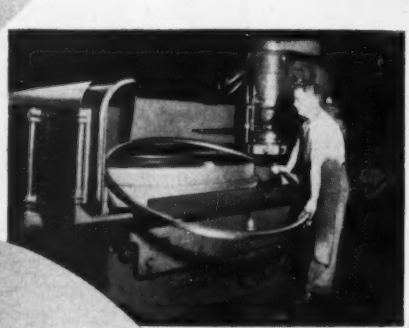
Smooth?

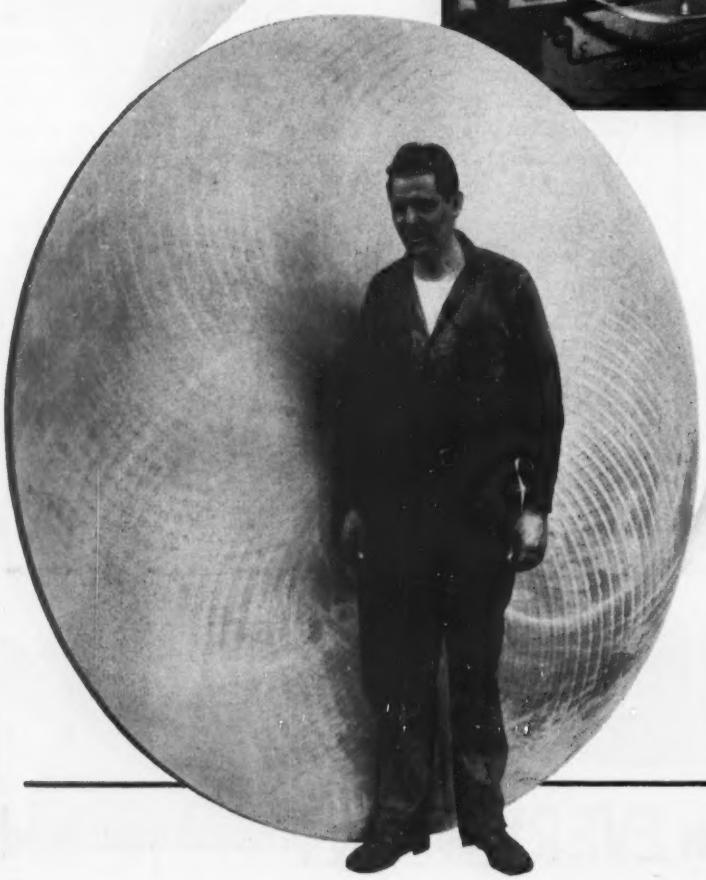
Of course! The Blanchard No. 11 finished this refrigerator plate, seen through an optical flat, to 3 micro inches and flat within 1 light band (.0000118").



Accurate?

Sure . . . and easy, too! This Blanchard grinds 84" forged steel rings flat within .0002", parallel to .0002", dimension tolerance of ±.0005", and with surface finish of 4 micro inches.





Tremendous?

Yes . . . but fast! This 88" diameter cast-iron plate was ground on a No. 42-72-84 Blanchard in 3½ hrs., floor to floor. ¼" of stock—1520 cu. in.—380 lbs. was removed.

If you produce flat surfaces, your best bet is Blanchard Grinders—with Blanchard Wheels!

PUT IT ON THE BLANCHARD

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE CO.
64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

Here's Another Cimcool Booster!

Naturally Cimcool° gets a rousing cheer from housewives on washday. Because this radically new and different cutting fluid *doesn't soil clothes!*

And that's just *one* of the many reasons workers prefer Cimcool. It can't smoke. Can't burn. Doesn't soil hands. Contains no skin irritants. Leaves no dangerous slippery film on machine, work or floor. Virtually eliminates rancidity and foul odors. And, unlike old-fashioned cutting fluids, Cimcool is so effective that work and tools really stay cool to the touch.

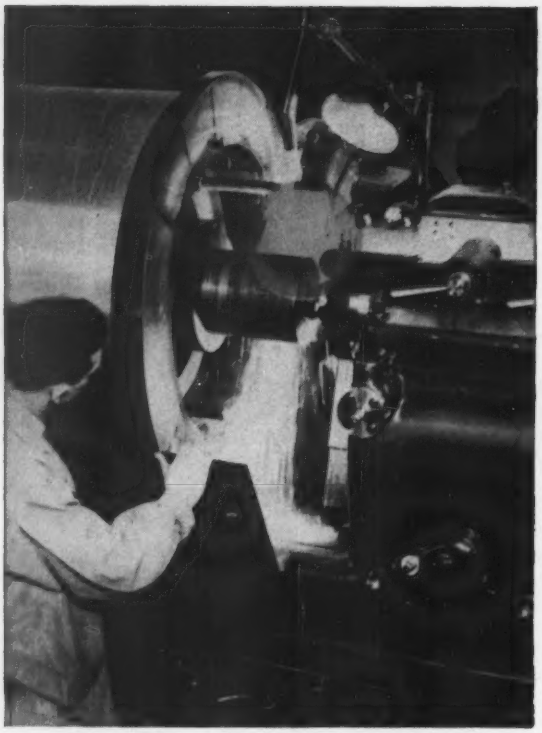
You'll appreciate Cimcool, too, when you see how this chemical emulsion takes over 85% of all metal cutting operations. For a demonstration in one of your own machines, just write us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or, if you prefer, write for our free booklet, "CIMCOOL Defeats Heat." Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

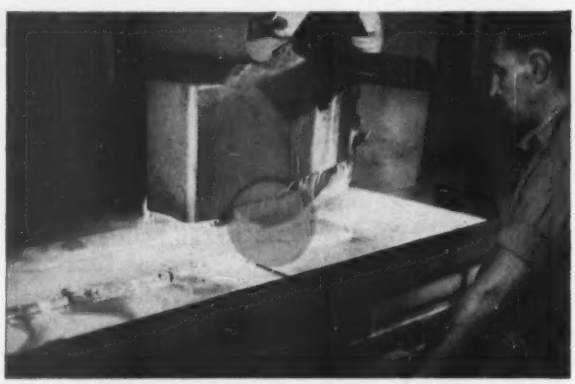
CIMCOOL

for 85% of all metal cutting jobs

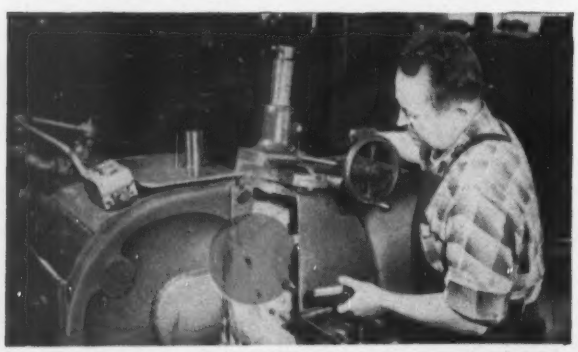
A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.



YOU CAN SEE THE DIFFERENCE. The spark stream from a Norton G Bond ALUNDUM wheel is more continuous, more even, indicating uniformity of wheel structure and of cutting action.



YOU CAN HEAR THE DIFFERENCE. Norton G Bond wheels grind with the pleasant, steady swish-h-h of free, easy cutting. You hear no harsh grinding noise.



YOU CAN PROVE THE DIFFERENCE. From general purpose to high production work, every job you do with the new G Bond wheels will benefit by the unique cutting action that grinds faster, freer, and cooler.

NOW!...Boost your profits with the NEW

G BOND

for your latest Norton value-adding

"TOUCH OF GOLD"

It took five years of continuous research and field-testing to bring you the new, exclusive Norton G Bond.

Now the most efficient vitrified bond ever produced is ready to add your latest "Touch of Gold" for increased product-value — and profits — in a wide range of precision and semi-precision grinding jobs.

Secret of the new G Bond's great superiority is the way it holds each abrasive grain for maximum cutting action. Then, *just when it should,* it lets go, assuring a constant grinding surface of new grains with fresh, sharp cutting edges. It is designed to do this better than the bond in any wheel you have ever used before.

As a result, Norton ALUNDUM* grinding wheels made with the new G Bond have definite advantages that you can *see* and *hear* as they grind — and that are *proved* in the better work they turn out for less cost.

That's your newest "Touch of Gold" developed by Norton to help boost your profits and keep your operators happy. Make sure you add it to your production. And remember, only Norton offers you over 65 years of experience in abrasives, grinding wheels and grinding and lapping machines.

SEE YOUR NORTON DISTRIBUTOR

about arranging a test of the new G Bond ALUNDUM wheels in your plant. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

THE "TOUCH OF GOLD" IS JOB-PROVED. During extensive field-testing, the new Norton G Bond wheels have made a big hit with operators experienced in many types of grinding. Why not get first-hand reports on these radically improved wheels? Try them in your own shop.

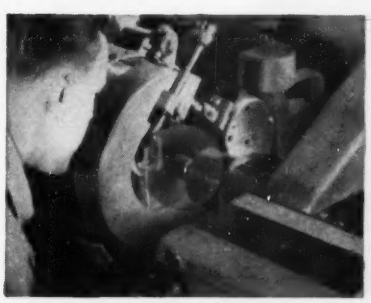
7 BIG ADVANTAGES Norton G Bond ALUNDUM Wheels:

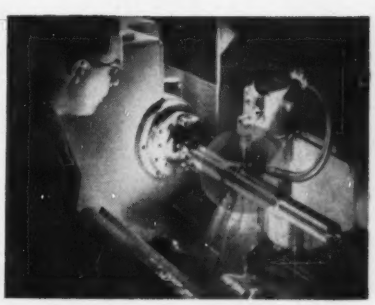
- Do more work per wheel
- Cut freer, cooler, faster
- Dress easier — more pieces per dressing
- Cover a wider range of jobs
- Hold shape — better for form grinding
- Hold corners better
- Ideal for crush dressing

NORTON
ABRASIVES
Making better products to make other products better

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

W-1475





BROAD USEFULNESS. The new Norton G Bond ALUNDUM wheels can boost your profits on many types of grinding, especially cylindrical, centerless, surface, internal, gear, tool and cutter, form and thread grinding, and saw gumming.

SUPERFINISH
MAKES THESE PARTS BETTER
...5 WAYS!

You're looking at a group of parts that go into the Gisholt Fastermatic Automatic Turret Lathe. Super-smoothness of working surfaces of these parts is vital to the precision and long life of the machine. So all these parts are Superfinished—including overhead pilot bars, piston rods, hydraulic control valves, thrust collars, turret locating pins and rollers.

The benefits are many:

1. Superfinishing removes all chatter marks, grinder flats, "smear metal" and other surface irregularities.
2. It assures more nearly perfect geometrical forms. This means more uniform bearing surfaces. They therefore last far longer.
3. Superfinishing simplifies assembly because the surfaces are down to true "base metal"...and no break-in tolerances are required.
4. Superfinishing simplifies grinding and reduces spoilage.
5. The greater degree of smoothness makes the parts easier operating, reduces wear.

The net result of Superfinish here—as it can be in your case—is parts that perform better, last longer and cost far less in the long run. See how Superfinish can solve your problems of both wear and surface roughness. Get your copy of "Wear and Surface Finish," and complete textbook covering all phases of Superfinish.

Model 52-A General-Purpose Superfinisher

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT

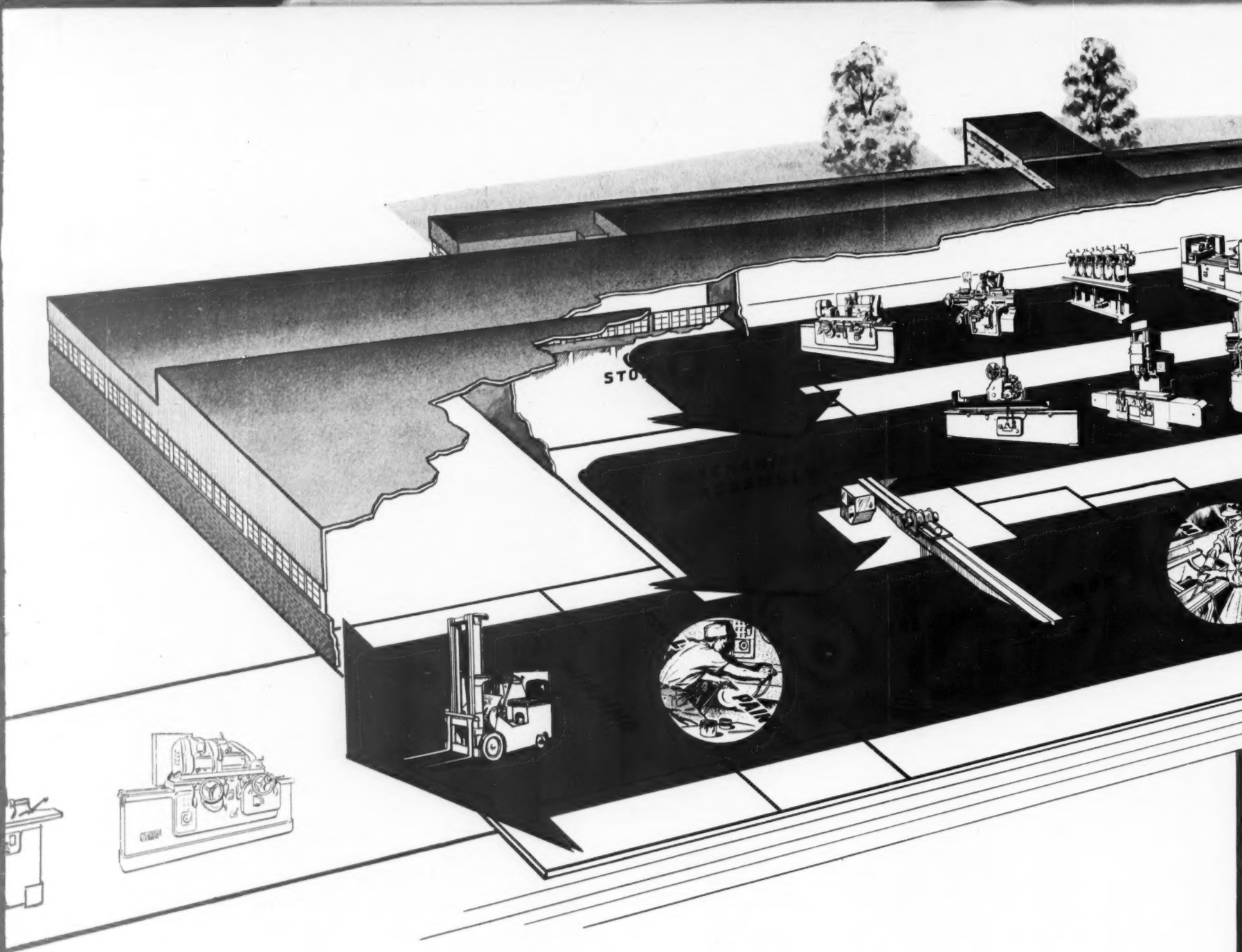
GISHOLT MACHINE COMPANY Madison 10, Wisconsin

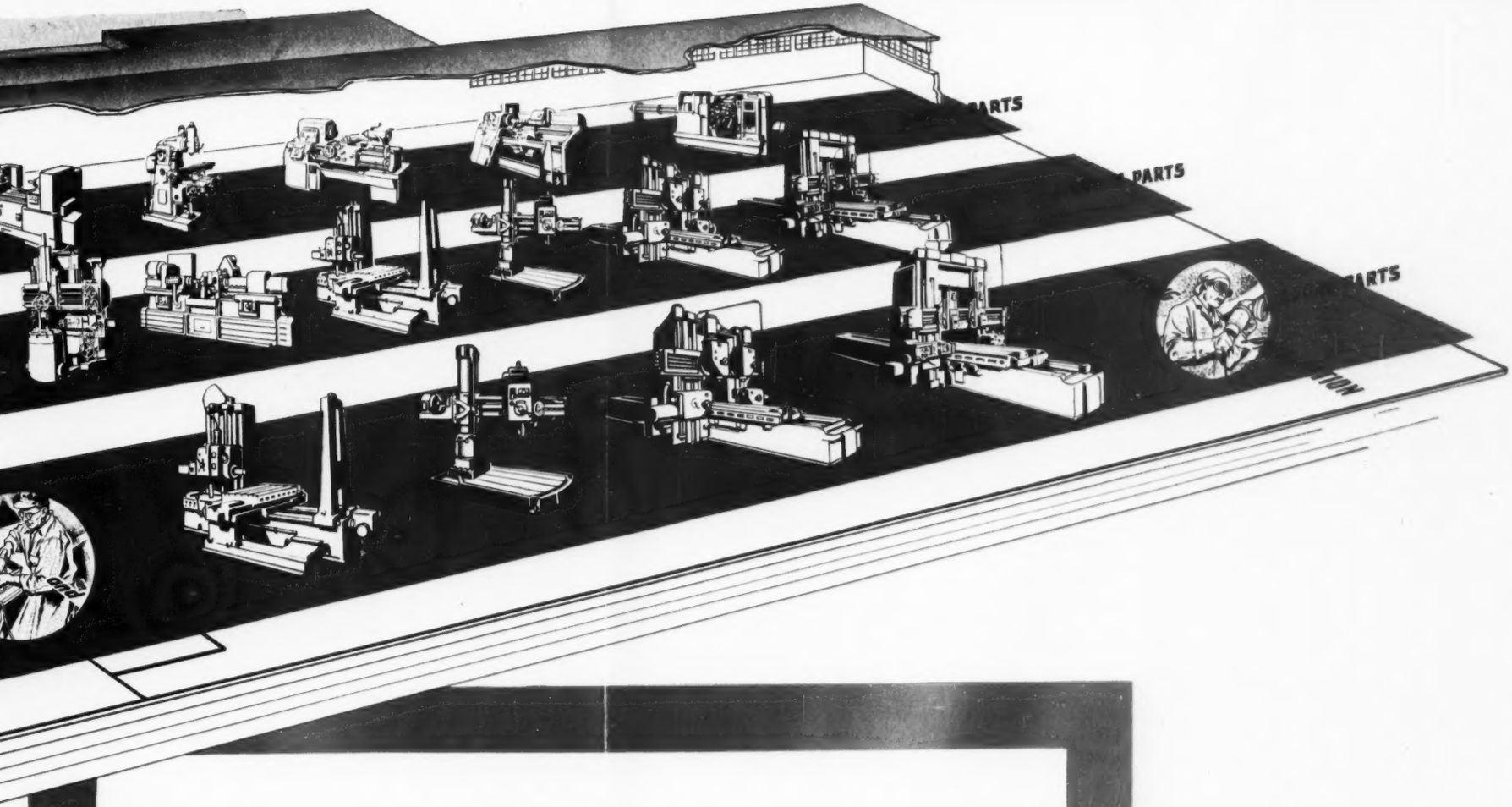
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Opening New Doors to the Future...

to Give Industry the

"TOUCH OF GOLD"





Flow Chart of the
New Norton Grinding Machine Plant

AT WORCESTER, MASS.

Open as a baseball diamond although many times larger. Production flows in-line, unusual in the construction of machine tools. Five major production lines are in operation, two for heavy castings and three for medium to small parts. Departmentalization has been eliminated in favor of continuous processing. Back-tracking and trucking are at the irreducible minimum. In this big ultra-modern fabricating plant, Norton Grinding and Lapping Machines are being built better than ever.

Your Norton Man Knows. He will be glad to talk with you at a planning level basis. As you look to the future in your own business, you can call upon the world's largest source of grinding machines, abrasives and abrasive products for the most recent developments in grinding operations. Or, if you wish, write direct for more information on any project you may now have under consideration. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

ONLY NORTON OFFERS YOU OVER 50 YEARS OF COMBINED EXPERIENCE IN:

ABRASIVES AND GRINDING WHEELS

PLUS

MACHINES FOR

Cylindrical Grinding • Surface Grinding
Cylindrical and Flat Lapping
Universal Tool and Cutter Grinding
Universal Multipurpose Grinding
Specialized Grinding • Crankshaft Grinding
Cam Shaft and Contour Grinding
Roll Grinding

FREE-FLOW PRODUCTION is the method employed in this new Norton plant. This is a scene in the production line for medium weight parts. Note how freely material-handling trucks can move in and out — how accessible the work is — how openness, controlled ventilation and perfect light add to workers' efficiency and morale.

NORTON *Making better products to make other products better*

NORTON COMPANY, MACHINE DIVISION, WORCESTER 6, MASS.

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

Printed in U. S. A.

NORTON COMPANY

MAIN OFFICES AND WORKS • WORCESTER, MASS.

NORTON

ABRASIVES AND GRINDING WHEELS • GRINDING AND LAPPING MACHINES • REFRACTORIES AND LABORATORY WARE
BORON CARBIDE GRAIN AND MOLDED PRODUCTS • PULPSTONES • NON-SLIP FLOORS • LABELING MACHINES

WORCESTER 6, MASSACHUSETTS

June 1, 1953

To Our Customers
and Other Friends:

We are now operating our new Grinding Machine plant at Worcester, Mass.

It is a new seven-acre plant of Norton Company that has grown up making better products to make other products better. We believe it is the most modern plant of its kind in the world. It will help us serve our many customers better.

However, in a larger sense we see this as much more than the mere opening of an additional plant. It symbolizes the Norton attitude toward American industry of the future. As the demand for greater precision and finer finish in products increases, the part grinding and lapping plays becomes more important. We think that we are actually anticipating industry's needs in this new plant - not merely keeping in step with progress.

We often speak about Norton Grinding Machines and Wheels giving your men in the shop the "Touch of Gold". This means that every time a Norton wheel on a Norton machine grinds a product in process it adds to its value and usefulness. You add to your profit margin without having to add to price. It is part of the American way of making goods better, faster, at lower cost. That is what this new plant is for.

This new plant will enable us to turn out better grinding machines in shorter time. We have greatly regretted that some customers have had to wait for certain types of machines, but we think that their patience will be rewarded by the finest machines we have ever produced in our half century of business. Deliveries are improving as the expanded facilities come into full use and we should now be able to meet all of your requirements.

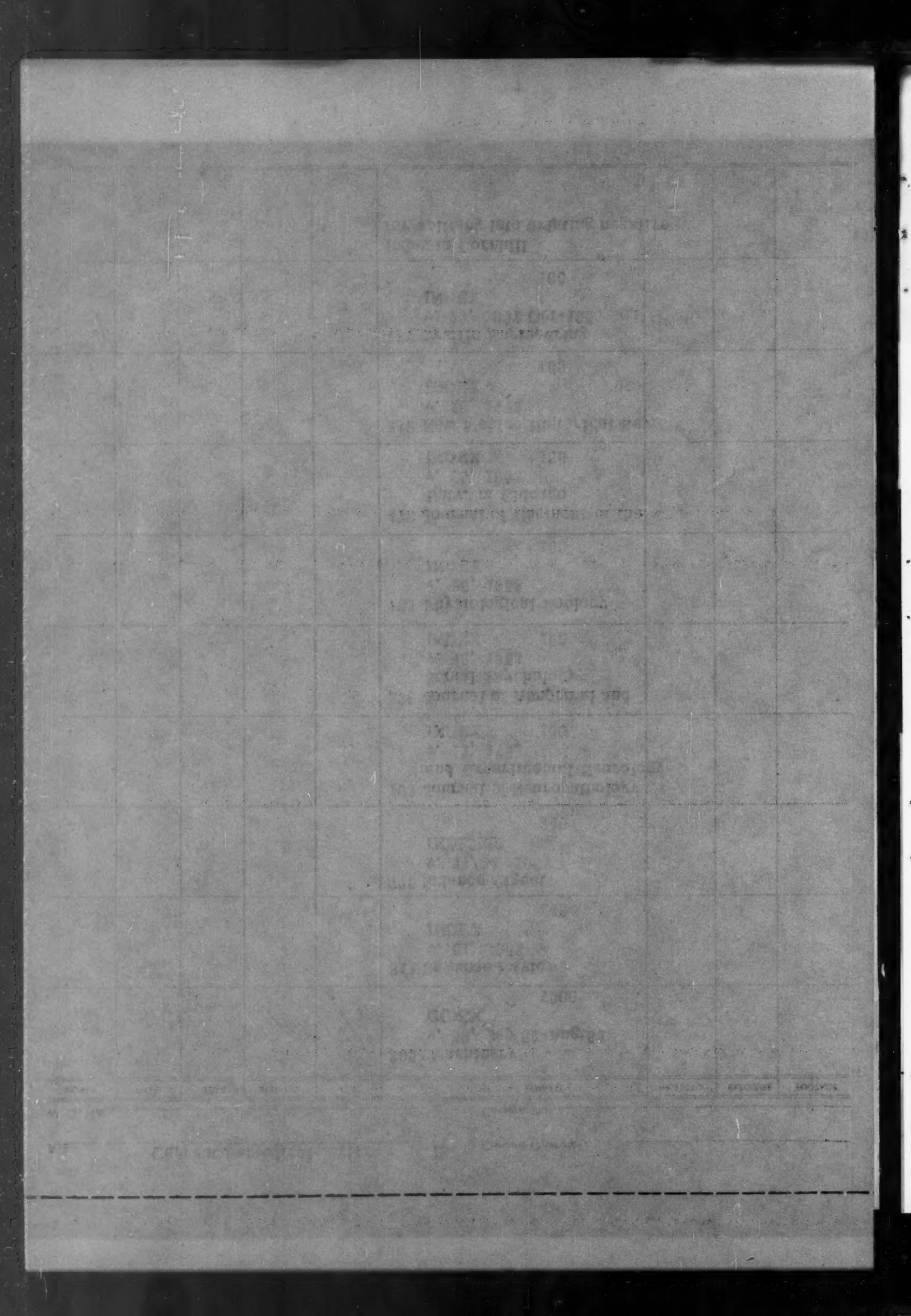
Please accept this as a personal invitation to visit us at Norton Company any time you are in New England. We feel sure you will find it interesting, inspiring and rewarding.

Sincerely yours,

NORTON COMPANY

Milton P. Higgins

President



Is high capacity in small space your problem?

here's how makers of outboard motors solve it with NEEDLE BEARINGS

Leading manufacturers of outboard motors specify Torrington Needle Bearings because of their high radial load capacity, their compactness and light weight.

They have been *performance-proved* in thousands of motors operating under all kinds of conditions.

Needle Bearings in connecting rods and on crankshaft mains, drive and propeller shafts of outboard motors increase operating efficiency and permit sustained high speeds when required.

Needle Bearings have become "standard equipment" throughout industry since their introduction nearly twenty years ago, wherever high capacity, compactness, ease of application, long service life and low cost are important.

Perhaps Torrington Needle Bearings are the solution to your anti-friction problems. We'll be glad to help you find out.

THE TORRINGTON COMPANY
Torrington, Conn. South Bend 21, Ind.

TORRINGTON NEEDLE BEARINGS

Needle • Spherical Roller • Tapered Roller • Straight Roller • Ball • Needle Rollers

Trade-marks of leading makers of outboard motors who use Torrington Needle Bearings.

EVINRUDE MOTORS · MERCURY OUTBOARD MOTORS · Martin · Scott-Atwater OUTBOARD MOTORS · Chris-Craft · Johnson · Elgin

Europe's largest producer of heavy tools introduces

4 PAGES OF NEW HEAVY DUTY SCHIESS MACHINE TOOLS

and announces the formation of

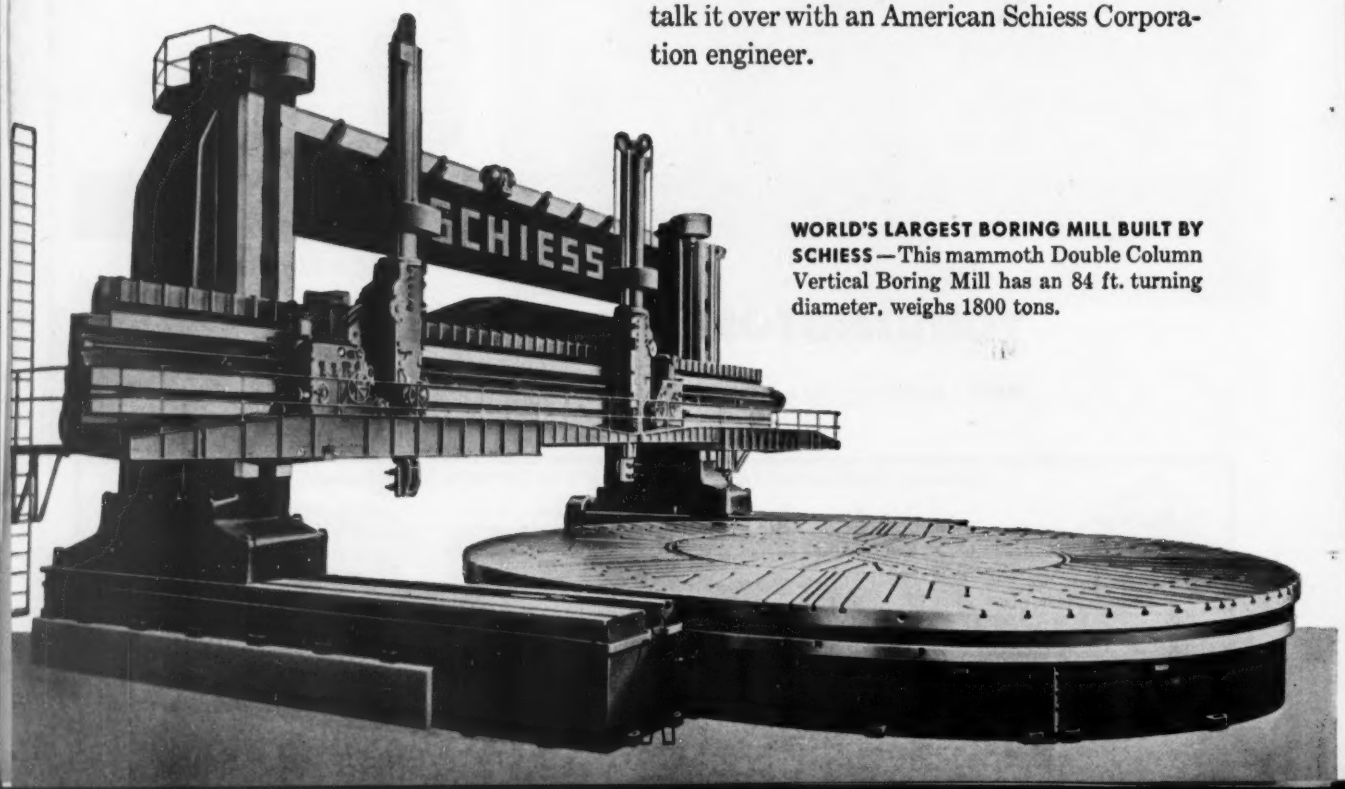
AMERICAN
SCHIESS
CORPORATION

with Schiess factory engineers at the Pittsburgh Service Center to supervise installation and servicing, and for consultation on special requirements.

Machine tools don't come much bigger—or better—than SCHIESS builds them, and has been building them for over 80 years to meet the precision requirements of the world's largest metalworking plants.

Now American Industry can also obtain these world-famous heavy producers with assurance that the same stand-by factory-trained engineering assistance will be permanently available here just as if the Schiess plant was located in the U.S.A. Spare parts will also be stocked here.

The newest Schiess machines—many already in operation in major American plants—are briefly described on these four pages. But you'll want the whole story on the particular equipment that's just right for your job. So talk it over with an American Schiess Corporation engineer.

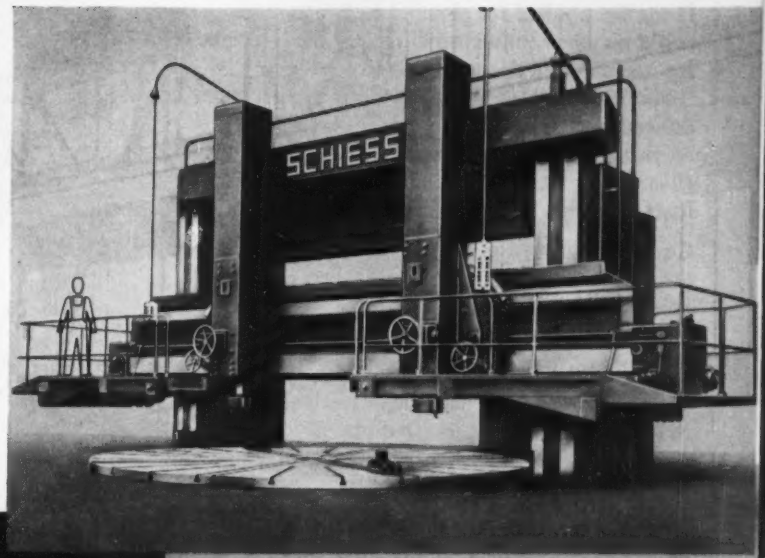


WORLD'S LARGEST BORING MILL BUILT BY SCHIESS—This mammoth Double Column Vertical Boring Mill has an 84 ft. turning diameter, weighs 1800 tons.

See the machines at
Canadian International Trade Fair, Toronto
Booths 4441-4449 and 4542-4550 Bldg. E4
June 1-12

By combining basic Schiess elements, extra heavy machines that would normally be considered special tools, can be built to your work diameter and load requirements.

The equipment shown here is typical of unusually large boring mills of latest Schiess design which, like the smaller models, incorporate new operating features listed below.



NEWLY DESIGNED

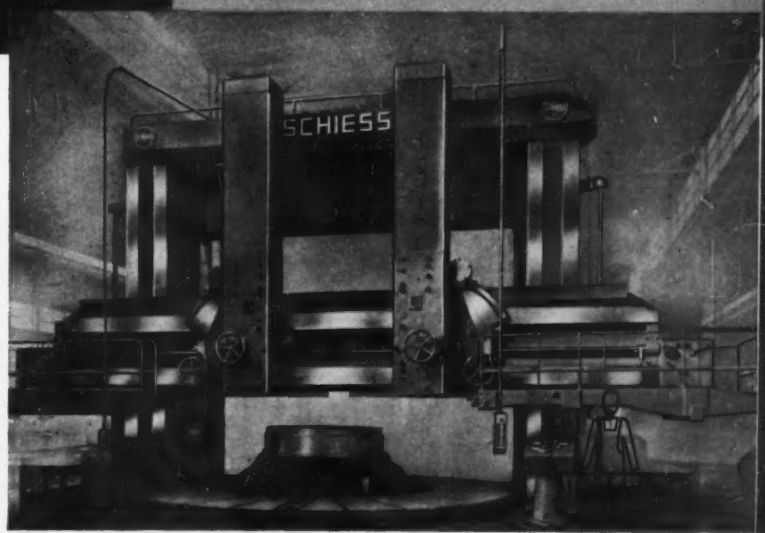
HUGE VERTICAL BORING & TURNING MILLS *like these* -

Built from basic Schiess designs to any diameter from 10 ft. to 84 ft.

Model 3K Vertical Boring Mill with 15 ft. turning diameter

MORE SCHIESS TOOLS

Model 5K Vertical Boring Mill with 22 ft. turning diameter



Fingertip Speed Control

Counterbalanced cross rail and side head

Octagon rams which can be swiveled, completely enclosed

Pendant Control

Automatic Lubrication

Vertical Boring Mills of this type can be equipped with inner and outer tables—and with 1 or 2 operator control panels.

Engineering Division

AMERICAN SCHIESS CORPORATION

38th Street and AVRR, Pittsburgh, Pennsylvania

Sole Distributor

KO KURT ORBAN COMPANY, INC.

205 East 42nd St., New York 17 • 4220 Prospect Ave., Cleveland 3
19450 James Couzens Highway, Detroit 35 • 1939 Santa Fe Ave., Los Angeles

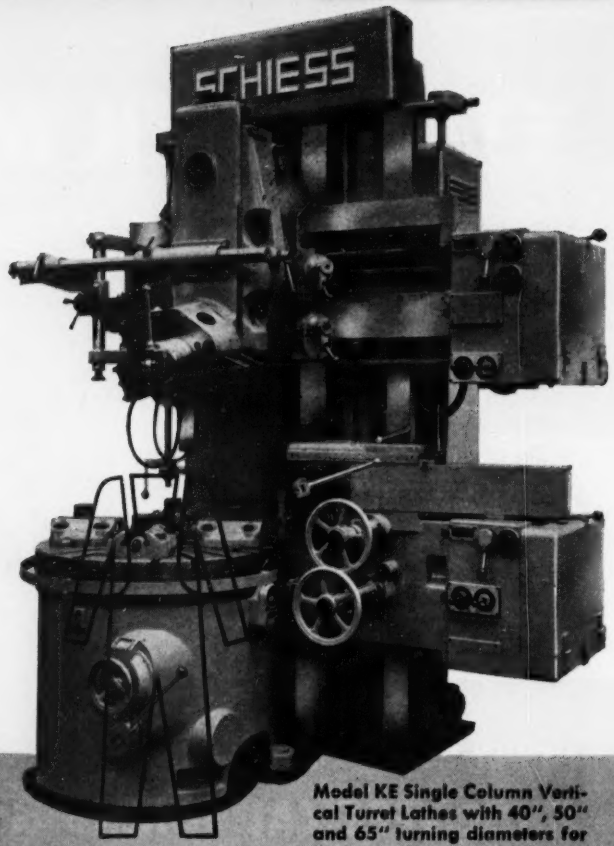
Hydraulic pre-selection of speeds set by handwheel and read on illuminated dial. 16 spindle speeds—ratio 1:50—up to 310 rpm for carbide machining on Model KE 100. Table runs on tapered roller bearings.

Fingertip control for direction of feed and rapid traverse with spring-loaded mono-levers for normal direction plus angular compound feeds. Mono-levers move in same direction as desired feed or traverse movement, simplify correct setting by operator. Specially designed electro-magnetic disc clutches disengage feed instantly with no over-riding or coasting.

Counterbalanced cross rail and side head. Single lever unlocks, raises or lowers, and locks cross rail simultaneously by electro-mechanical controls. *No bolts or nuts to loosen or tighten by hand.*

All-vertical gear drive with main motor mounted on back of machine, directly connected to gear box. Changes in direction of drive transmitted to table without bevel gears, eliminating vibration and backlash.

Copying attachment with electric tracer for use either on cross rail or side head.



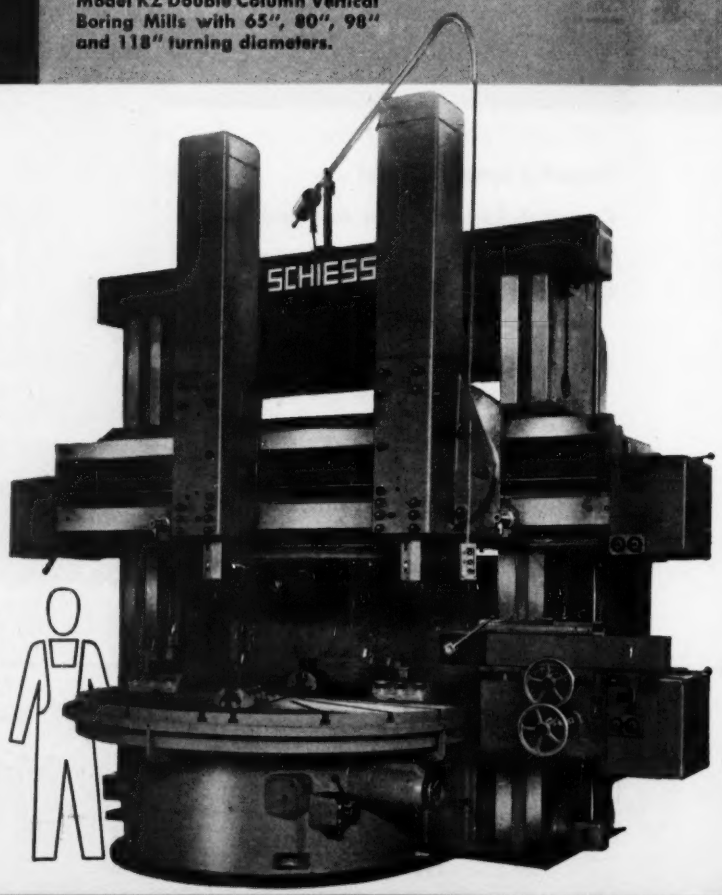
Model KE Single Column Vertical Turret Lathes with 40", 50" and 65" turning diameters for high-speed carbide machining.

NEWLY DESIGNED

VERTICAL TURRET LATHES AND BORING MILLS

like these -

Model KZ Double Column Vertical Boring Mills with 65", 80", 98" and 118" turning diameters.



All operating features of KE Series Vertical Turret Lathes are combined in the

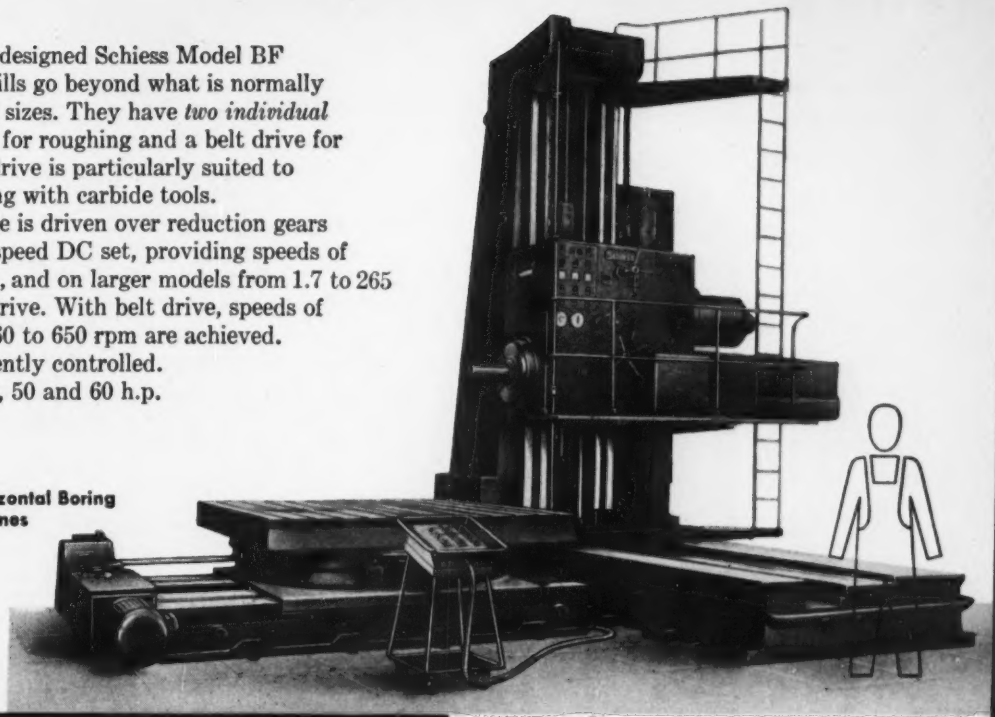
SCHIESS KZ DOUBLE COLUMN VERTICAL BORING MILLS, PLUS—

Heads equipped with steel octagon rams can be swiveled—have automatic feed in vertical, horizontal and angular direction and are independent of one another as to amounts and direction of feed. Table operated by three-button pendant control.

Schiess factory engineers are now permanently located at American Schiess Corporation's Pittsburgh Service Center to install and service Schiess equipment, train operators and consult with your engineers on special-purpose equipment.

These completely redesigned Schiess Model BF horizontal boring mills go beyond what is normally considered standard sizes. They have *two individual drives*—a gear drive for roughing and a belt drive for finishing. The belt drive is particularly suited to high-speed machining with carbide tools.

The boring spindle is driven over reduction gears through a variable speed DC set, providing speeds of from 2.7 to 325 rpm, and on larger models from 1.7 to 265 rpm with the gear drive. With belt drive, speeds of 30 to 750 rpm and 60 to 650 rpm are achieved. Rams are independently controlled. Main motors are 40, 50 and 60 h.p.



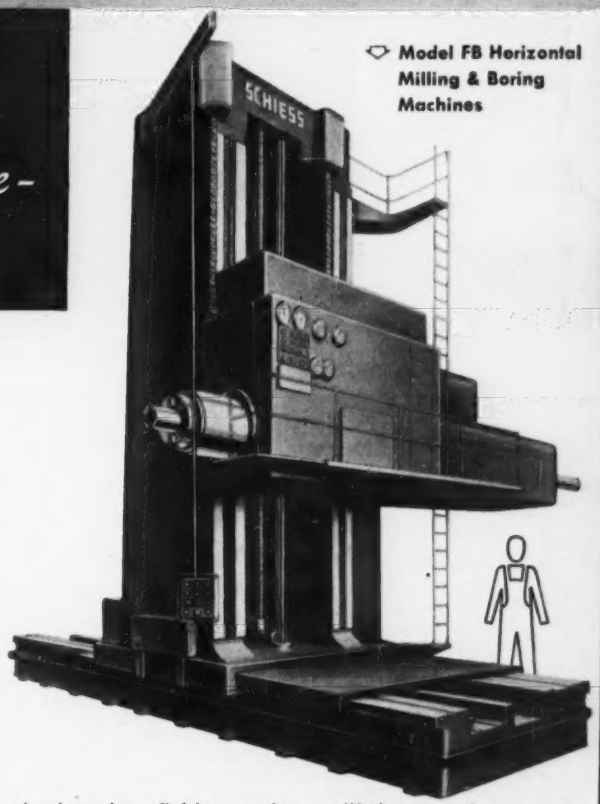
Model BF—Horizontal Boring & Milling Machines

NEWLY DESIGNED

HORIZONTAL BORING & MILLING MACHINES *like these*-

Standard sizes begin where other builders end

Spindle Diameters 6¼", 7½", 8⅞", 10⅜", 12⅜"



Model FB Horizontal Milling & Boring Machines

An entirely new development...

SCHIESS HORIZONTAL MILLING & BORING MACHINE

Here is a radically new departure in machine tools—the Schiess Model FB horizontal *milling* and *boring* machine. Rugged and precise, the Model FB is primarily designed for heavy milling cuts and for certain types of facing work. These limited specifications tell only part of the story of this unique machine:

Specifications	FB 28/16	FB 32/19	FB 36/22.5
Diameter of Milling Spindle.....	11"	12⅜"	14¼"
Diameter of Boring Spindle.....	6⅛"	7½"	8⅞"
Diameter of Milling Spindle Sleeve	18⅞"	21¼"	24"
Maximum diameter bored.....	35½"	55"	86½"
Maximum diameter faced.....	55"	86½"	102"
Main Motor.....	60 h.p.	60 h.p.	85 h.p.

Gear Drive for roughing, Belt Drive for finishing

An American Schiess engineer will show you how you can adapt this new type heavy producer to your special needs.

Engineering Division

AMERICAN SCHIESS CORPORATION

38th Street and AVRR, Pittsburgh, Pennsylvania

Sole Distributor

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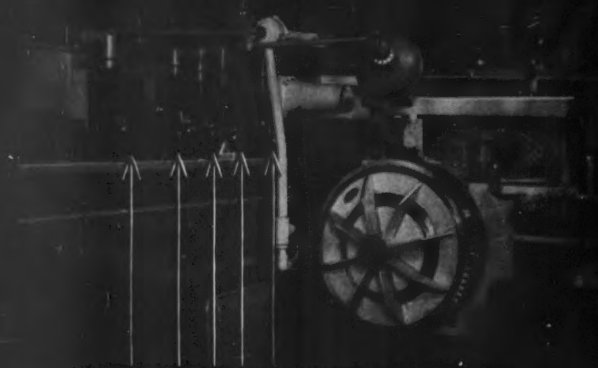
LAPOINTE offers



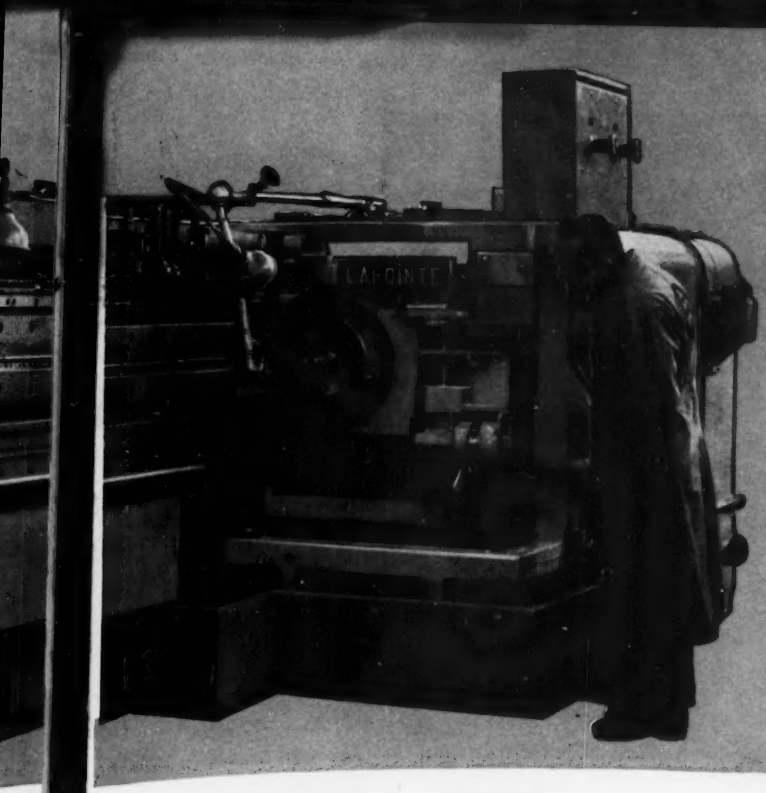
LIMIT SWITCHES for operating DUAL SPEED and DUAL CYCLE (Patented*)

The Dual Speed feature permits the machine to be operated at two predetermined speeds for the same broaching stroke. Dual Cycle is the exclusive LAPOINTE feature that has been developed for successful broaching of jet engine components without requiring tool changeovers for the accuracy required.

Two of the reasons for the smooth, positive functioning of this new LAPOINTE Broaching Machine are seen in this picture showing the large diameter continuous-tooth herringbone gear and rack, and the guiding of the massive main slide.

*No. 2,617,333

FASTER BROACHING OF JET ENGINE PARTS AND AUTOMOTIVE PARTS



LAPOINTE 30/180" SRHE, broaching Turbine Wheel J57.

The electro-mechanical drive accounts for the remarkable versatility and flexibility of this newly developed single ram horizontal broaching machine. Note that the cutters are at eye level.

new *ELECTRO-MECHANICAL DRIVE* horizontal BROACHING MACHINE

for *SURFACE BROACHING* at speeds up to *300 fpm!*

Now, for the first time, there is practically unlimited opportunity to make tests to determine the best broaching speed for any particular metal! Once the proper speed is found, this new LAPOINTE Broaching Machine will give

- **substantially increased production**
- **better finish and**
- **greater accuracy through freer cutting action.**

Carbide-tooth broaches and HSS broaches both perform exceptionally well on this machine, which is fully described in a new bulletin available on request. Ask for *Bulletin SRHE-1.*

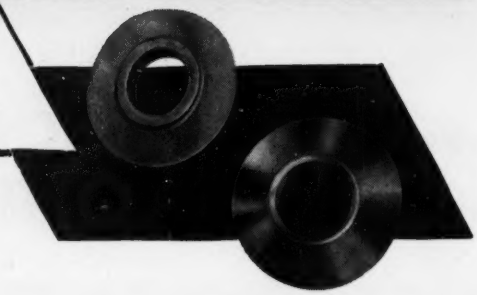
Another striking example of Lapointe engineering leadership, with everything designed and built at one source . . . no divided responsibility!

Industry looks to Lapointe for the latest developments in broaching machines, tools, and fixtures.

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

FASTERMATICS
Produce Faster— Pay Off Faster

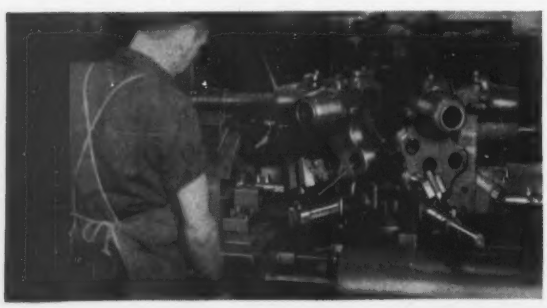


It may seem incredible, in this day and age, for any major machine tool to "buy" itself in nine short weeks of operation. But that's exactly what the Fastermatic Automatic Turret Lathe did on this job of machining clutch plate hubs.

Former time, on hand-operated turret lathes, was 15 minutes per piece. The Fastermatic, with automatic control of all machine functions, reduced the time to only 3 minutes, floor to floor.

Earnings piled up so fast over former production costs that the Fastermatic paid for itself in just 9 weeks—or 893 hours of operation.

Do you have work that permits a number of cuts in one chucking? Investigate the Fastermatics. You may have a big opportunity to increase production, cut costs and save man power.



In this tooling setup, only 3 turret faces are needed to turn each part. With duplicate tooling on the remaining 3 faces of the hexagon turret, 2 parts are machined with each complete turret cycle. The operator merely loads and unloads the work.

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

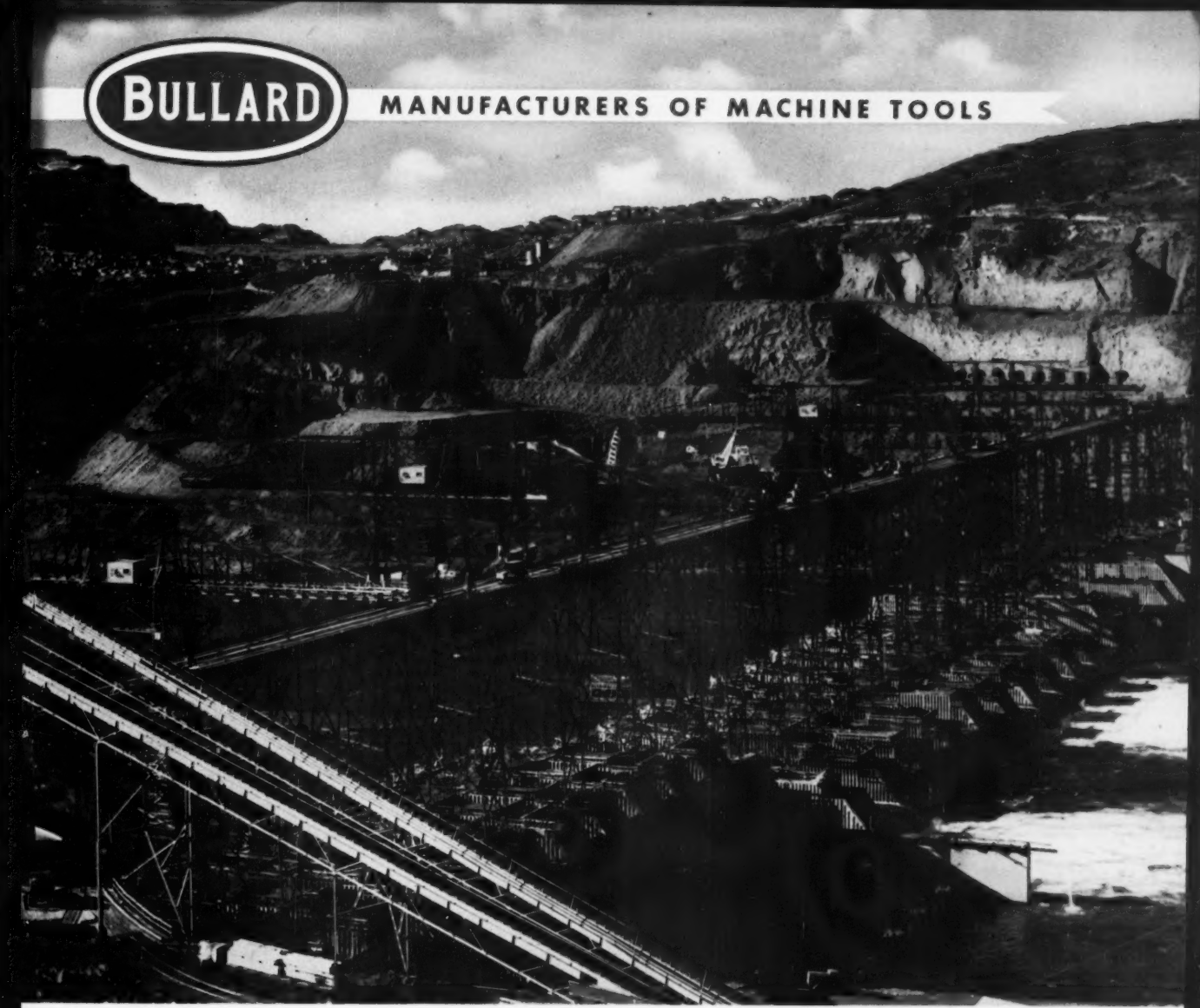
GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

BULLARD

MANUFACTURERS OF MACHINE TOOLS



Construction of Grand Coulee Dam

Wide World Photo

The Invisible Background of Industrial Progress

The influence of an engineering project such as the Grand Coulee Dam reaches far into many diversified industries. Located on the upper Columbia River in the state of Washington, this Dam covers 35 acres of land with its 25,000,000 tons of solid reinforced concrete. Such developments as this provide flood control, irrigation of previous waste lands, generation of power, increased employment and many other benefits that are plus factors in our American economy.

Construction of these huge projects requires many varied types of equipment as well as the numerous internal electrical, hydraulic and mechanical components, for which machine tools are the key manufacturing units.

★ The Bullard Company, builders of *Modern Machine Tools*, have consistently engineered and developed key manufacturing units for our American industries.

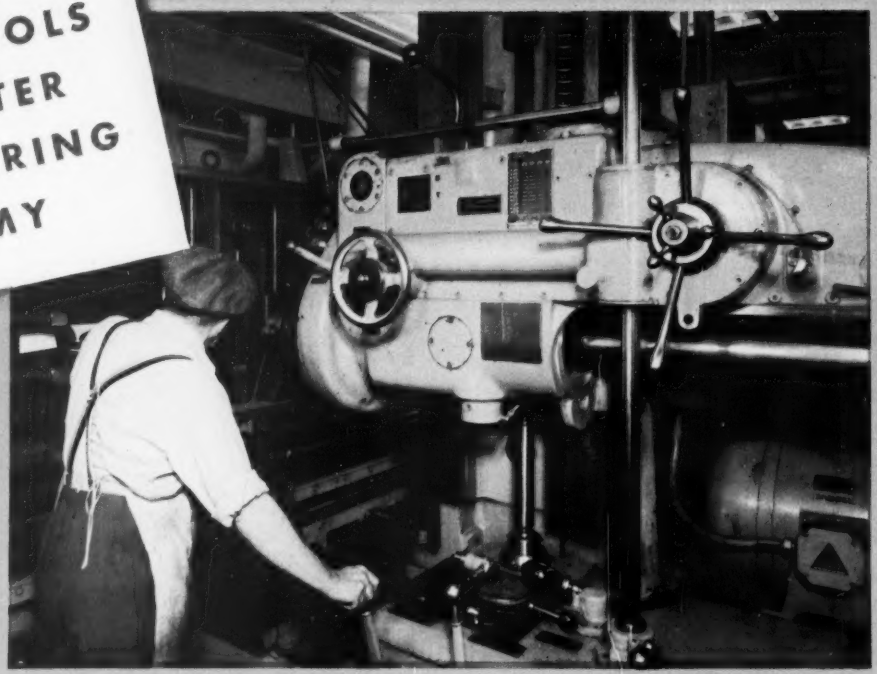
For small run jobs or mass production, Bullard Machine Tools will add a plus factor to your production economy.

★ *For greater manufacturing economy REFER to next page.*

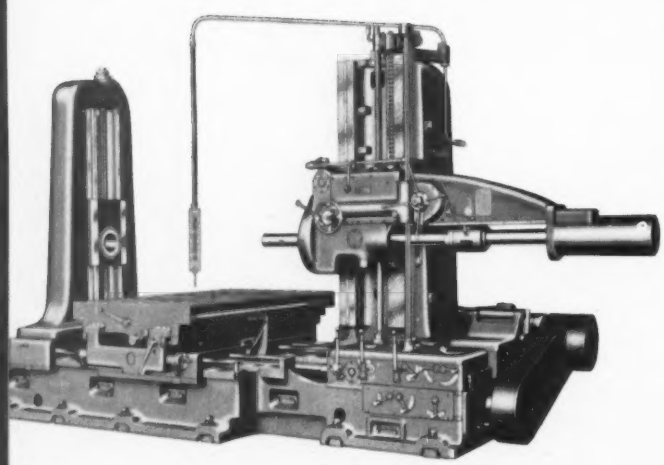
THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

BULLARD MACHINE TOOLS FOR GREATER MANUFACTURING ECONOMY



The Bullard improved design 4-Way Bed 4 inch and 5 inch spindle Horizontal Boring, Milling and Drilling Machines with a choice of Bed length, Post height and Table sizes assures economy and maintained precision for quality production.



Manufacturing costs of all products are directly related to the manufacturing methods used by the producer. Therefore, in today's competitive markets, modern machine tools are highly essential in obtaining the necessary production efficiency.

Bullard Machine Tools have always, and more than ever today, rate high in the assurance of manufacturing quality and economy.

Investment logic for improved manufacturing efficiency dictates the first consideration of American built machine tools.

The initial investment cost of Bullard machines with their low cost productive ability, outweigh the lower first cost of other similar machines.

BULLARD

Time saved is money earned. Write now for information on Bullard Horizontal Boring Machines.

THE BULLARD COMPANY BRIDGEPORT 2, CONNECTICUT

LOADING THE MOLD-MAKING MACHINE WITH RESIN-SAND MIXTURE.
HOT PATTERN PLATE CLAMPED TO MOLD-MAKING MACHINE.
INVERTING MACHINE TO DEPOSIT RESIN-SAND MIXTURE ON HOT PATTERN.
REMOVING PATTERN PLATE WITH ADHERED SAND RESIN CRUST.
OVEN CURING FRESHLY FORMED MOLD HALF.
EJECTION PINS REMOVING CURED MOLD HALF FROM PATTERN PLATE.

How SHELL MOLDING Pays off!

The shell molding process offers notable economies to the producer and user of ferrous and non-ferrous castings on short as well as long runs.

LONG RUN PRODUCTION. Shell molds yield castings almost pattern-smooth, with tolerances as close as .003 to .005 inches per inch. This feature greatly reduces finishing costs. Moreover, there is a high percentage of sound, uniform castings, with fewer rejects.

SHORT RUN PRODUCTION OF COMPLEX SHAPES. Such castings normally require finishing entirely by hand—at prohibitive cost. Shell molds are made of a resin-sand mixture that is perfectly suited to forming on intricate pattern plates. Shell molds can be stored without deterioration for intermittent production scheduling. They retain their shape until used.

SELECTION OF PROPER RESINS. BAKELITE Phenolic Resins are used to bond the fine-grained sands from which the thin, lightweight shell molds are made. Bakelite Company has developed several resins for this process, of which two meet most requirements. One provides resistance to distortion during the initial heat of pouring. The other provides accurate reproduction of intricately-detailed patterns, even those requiring deep draws.

ENGINEERING GUIDANCE. Selection and use of the correct bonding resin is important to successful shell molding. It is a step for which your foundry department or supplier may need expert guidance. Bakelite Company engineers, located in principal cities, are ready to help. Write Dept. PK-19

BAKELITE
TRADE-MARK
PHENOLIC RESINS FOR SHELL MOLDING

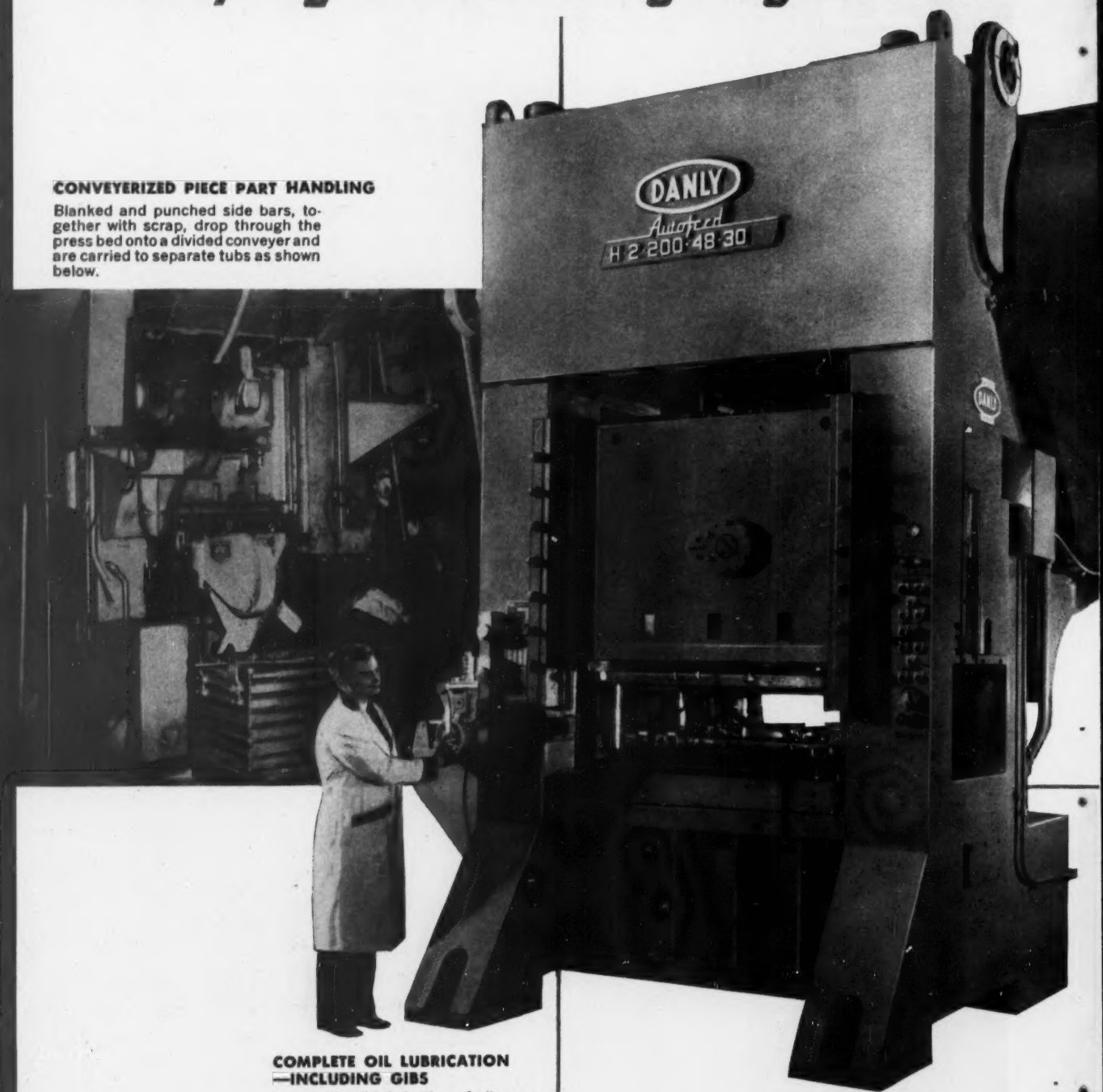
TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.
In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.

stamping costs are going down!

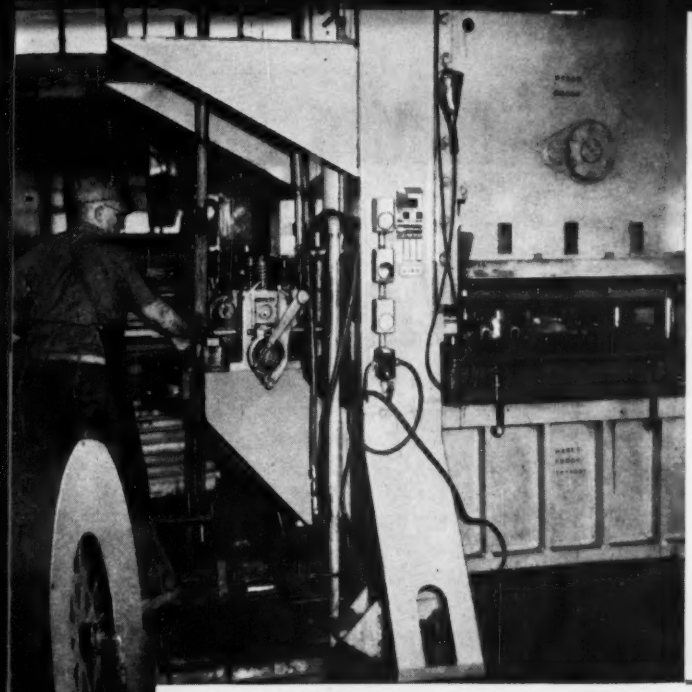
CONVEYERIZED PIECE PART HANDLING

Blanked and punched side bars, together with scrap, drop through the press bed onto a divided conveyer and are carried to separate tubs as shown below.



COMPLETE OIL LUBRICATION —INCLUDING GIBS

Automatic oil lubrication of gibs permits extremely close alignment of slide and more accurate guiding of dies—greatly decreasing die wear. Clean filtered oil continuously supplied to all wear surfaces is only one of Danly's outstanding "preventive maintenance" features.



AUTOMATIC FEEDING
In this setup, alloy steel side bars ⅜" thick are blanked and punched in a multiple stage die at a high rate of speed. Dies like these last 200% longer in Danly Presses.

DANLY PRESSES *do it!*

JEFFREY MANUFACTURING COMPANY REPORTS:

- *50% faster production*
- *200% longer die life*
- *greatly decreased maintenance*

The 200 ton Danly Autofeed Press shown here has been in continuous daily operation at the Jeffrey Manufacturing Company, Columbus, Ohio, for well over a year – *without maintenance* of any kind other than routine oil change. Steady performance like this and the faster stroking permitted by Danly's rigid, precise construction have raised average production of steel conveyor chain side bars from 3,000 per hour to 4,500 per hour.

Dies are lasting longer, too. In one case a 3-stage die required grinding every 10,000 pieces – now, in the Danly Autofeed Press, the same die turns out 30,000 pieces between grinds.

A story like this is typical of Danly Press performance in leading stamping plants throughout the country – and proof that Danly Presses reduce stamping costs!

SEND FOR YOUR COPY TODAY!

. . . see how you can put Danly Presses to work in your plant to increase production and cut costs.

DANLY MACHINE SPECIALTIES, INC.
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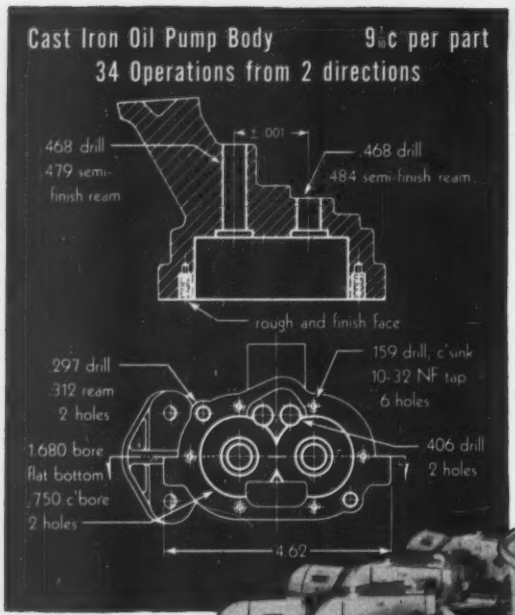
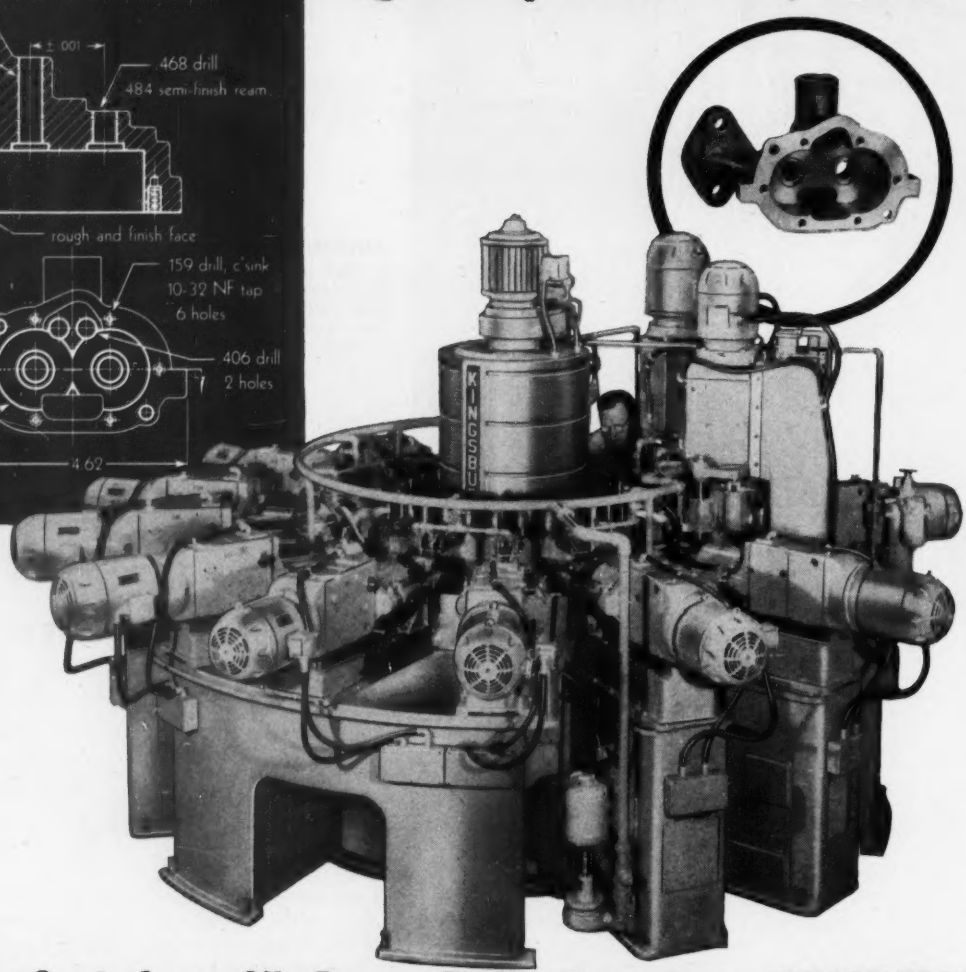
MECHANICAL PRESSES . . . 50 TO 3000 TONS
HYDRAULIC METALWORKING EQUIPMENT

It costs less to run a DANLY PRESS!

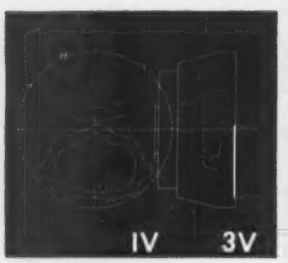
Single Action Straight Side | Autofeed | Underdrive Single, Double Triple Action | Gap Frame | Double Action Straight Side

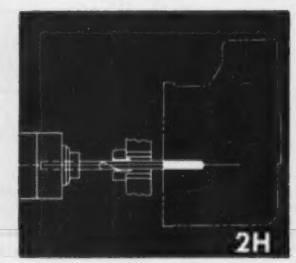
Higher production, lower

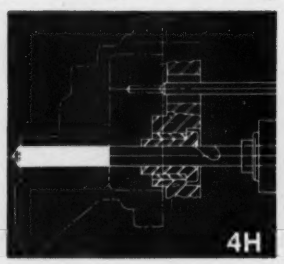


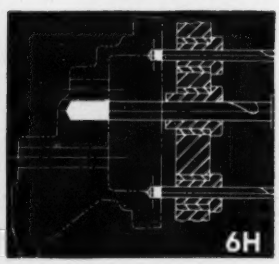


Follow this Cast Iron Oil Pump Body through a KINGSBURY









This Kingsbury accomplishes 34 operations from two directions. It mills, drills, bores, c'sinks, reams and taps. Used by a leading automotive manufacturer for a cast iron oil pump body, it produces 200 parts per hour gross; has a central column with an 84-inch base and a 60-inch index table with 14 stations. Of the 13 units, two are vertical (V) and 11 are horizontal (H). Eight of these units have multiple spindles.

Thirty-four operations are accomplished by one man on this one machine. Follow through and see:

Unit 1-V (Station 1 vertical) rough mills the base of the large flange. This milling operation employs our heaviest milling unit: about as large as we care to handle.

Unit 2-H with six-spindle head drills six .159 holes .74 deep.

Unit 3-V finish mills the face.

Unit 4-H countersinks three of the .159 holes and drills a .453 hole.

Unit 5-H countersinks the remaining three .159 holes and drills a .438 hole.

Unit 6-H drills a .406 hole and two .297 holes.

At *Unit 7-H* another .406 hole is drilled and the .297 holes are .312 reamed.

costs, soon pay for a Kingsbury

Combined operations on a Kingsbury bring you distinct advantages.

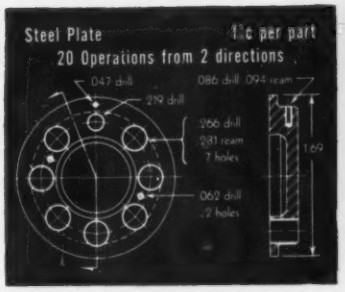
You benefit from the combined operations of a Kingsbury special purpose production machine. Output per man hour is increased. The part is not moved after once being chucked. It travels through a work cycle where units of from ½ to 5 hp each drill, ream, c'bore, mill, tap, thread, etc., accurately and automatically.

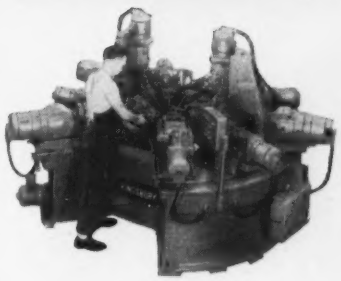
These combined operations cut production costs. Only one operator is required. He loads and unloads the machine. Handling of each part is reduced to this one chucking operation. There is almost no scrap loss — each part is machined uniformly to specifications. Less floor space is required than for separate machines.

If you are interested in further information on these special purpose machines, we'd be pleased to hear from you.

Kingsbury Machine Tool Corp.,
101 Laurel St., Keene, N. H.

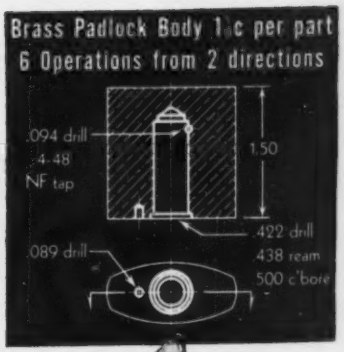
KINGSBURY
AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production

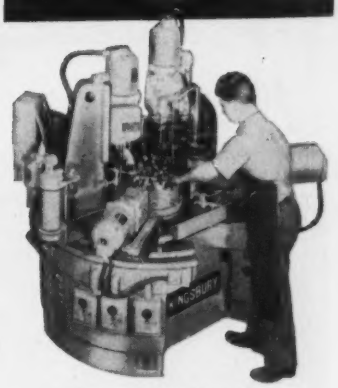




Steel Plate
540 parts per hour gross
1 6/10¢ per part

This part measures only 1.69 OD, and contains 12 holes. Most of these are partial holes. The machine has two Vertical Units and nine Horizontal Units operating 20 spindles in all. Close center distances prevent the use of more than two spindles at any one unit. Rigid tolerances must be held.

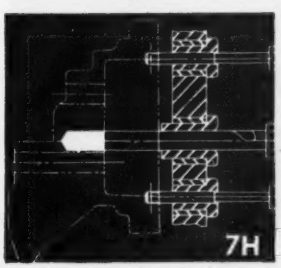


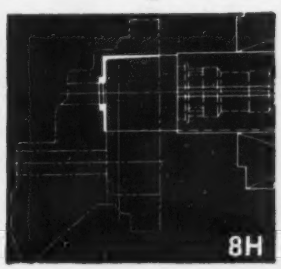


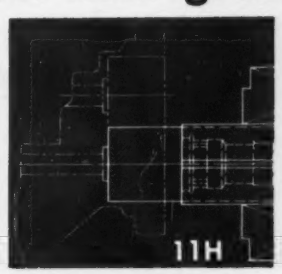
Brass Padlock Body
460 parts per hour gross
1 1/10¢ per part

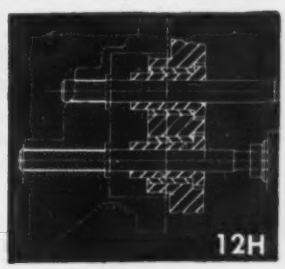
This is a comparatively simple machine with six operations, four horizontal, two vertical. It drills, c'bores, reams and taps — all automatically. The machine is compact with 60" diameter base, 12" diameter index table, six fixtures and six drilling units. Bushings guide drills and reamers.

as it produces 200 parts per hour gross at 9 7/10¢ each









Units 8-H, 9-H, 10-H, 11-H

Here we work on the thru-holes and large bores with combination tools; really the most interesting operations. Drawings 8-H and 11-H illustrate these operations. A 1.680 hole is rough bored at both Unit 8-H and 9-H, each with a flat bottom and .750 c'bore. These two 1.680 holes then receive a semi-finished bore with flat bottom at Units 10-H and 11-H.

Unit 12-H. The .484 holes bored at 4-H and 5-H receive a semi-finished ream.

Unit 13-H with six 10-32 NF taps performs the tapping operation in the six holes drilled by Unit 2-H.

Operator stands at the 14th station when he loads and unloads the machine. An air cylinder clamps and unclamps the work fixtures.

Each Unit Cost on the drawings includes the cost of the man and of the machine — no power or overhead. We assumed:

Unit cost of man equal to:

$$\frac{\text{average U. S. hourly wage}}{\text{hourly gross x 80\% efficiency}}$$

Unit cost of machine to be:

$$\frac{\text{price of tooled machine}}{\text{output in 6000 hrs. @ 80\% efficiency}}$$

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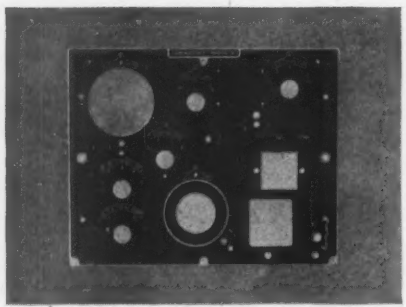

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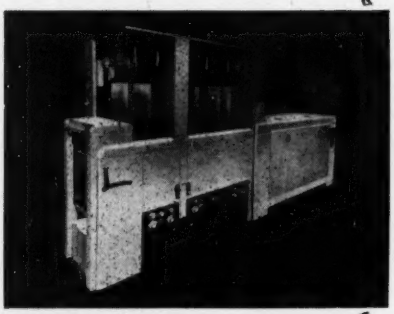

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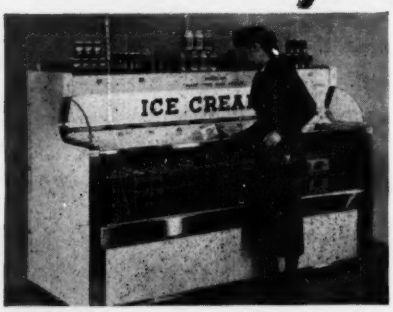
VENDING MACHINES
The Vendo Company
Kansas City, Mo.



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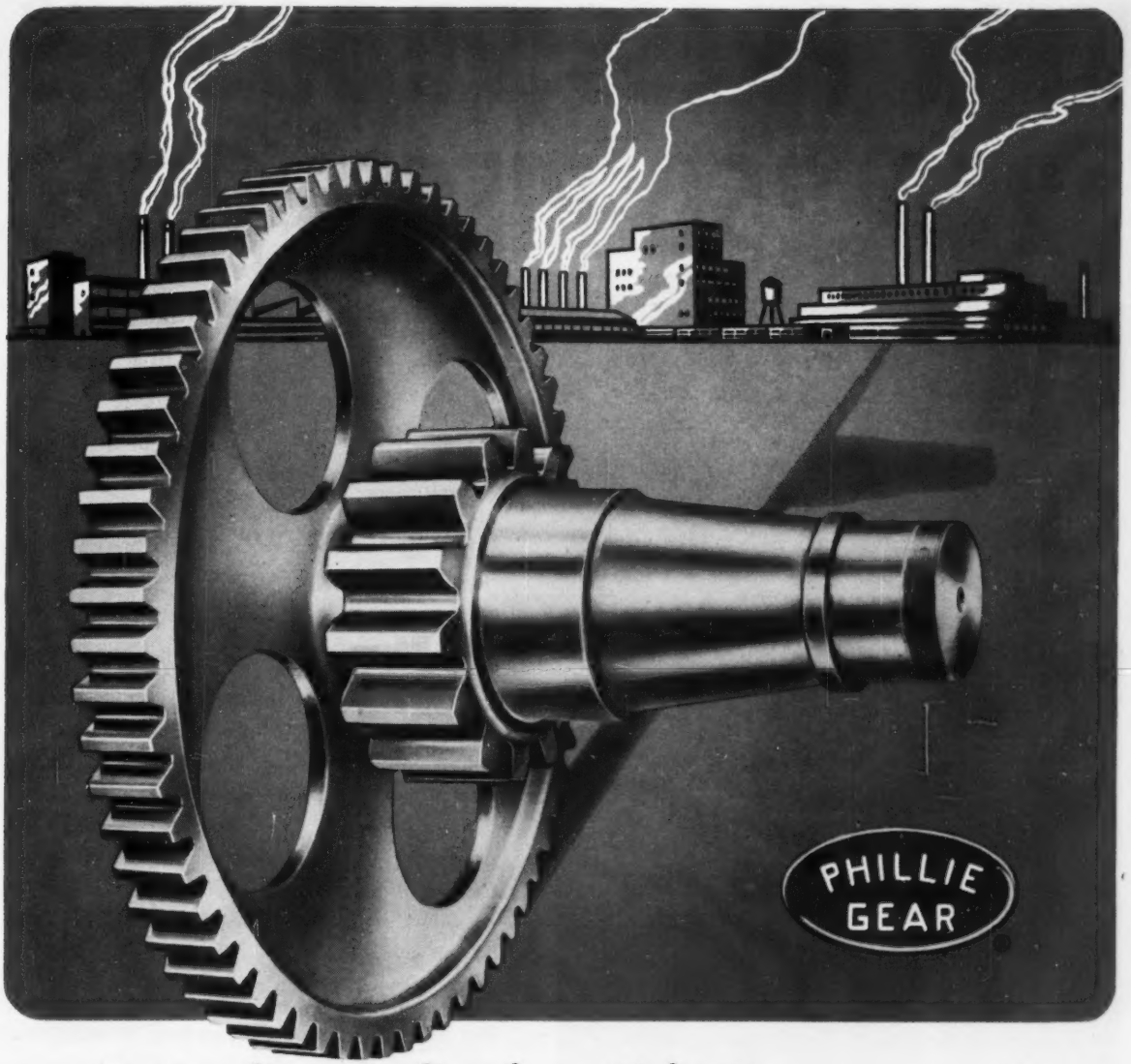

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AND IT'S STILL GOING STRONG!

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Let KRW help you with your pressing problems. Our engineers can show you how to save time and money in your shop with a KRW Hydraulic. We have a complete line of one, two and three cylinder models; 25-150 Ton capacities; hand, air or motor driven. KRW Presses are all self-contained above ground and give you maximum tonnage at any part of the stroke.

• Write for free illustrated brochures with detailed specifications and prices. Dep't. 15.

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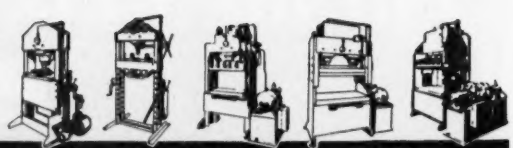

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They're new
They're high in quality
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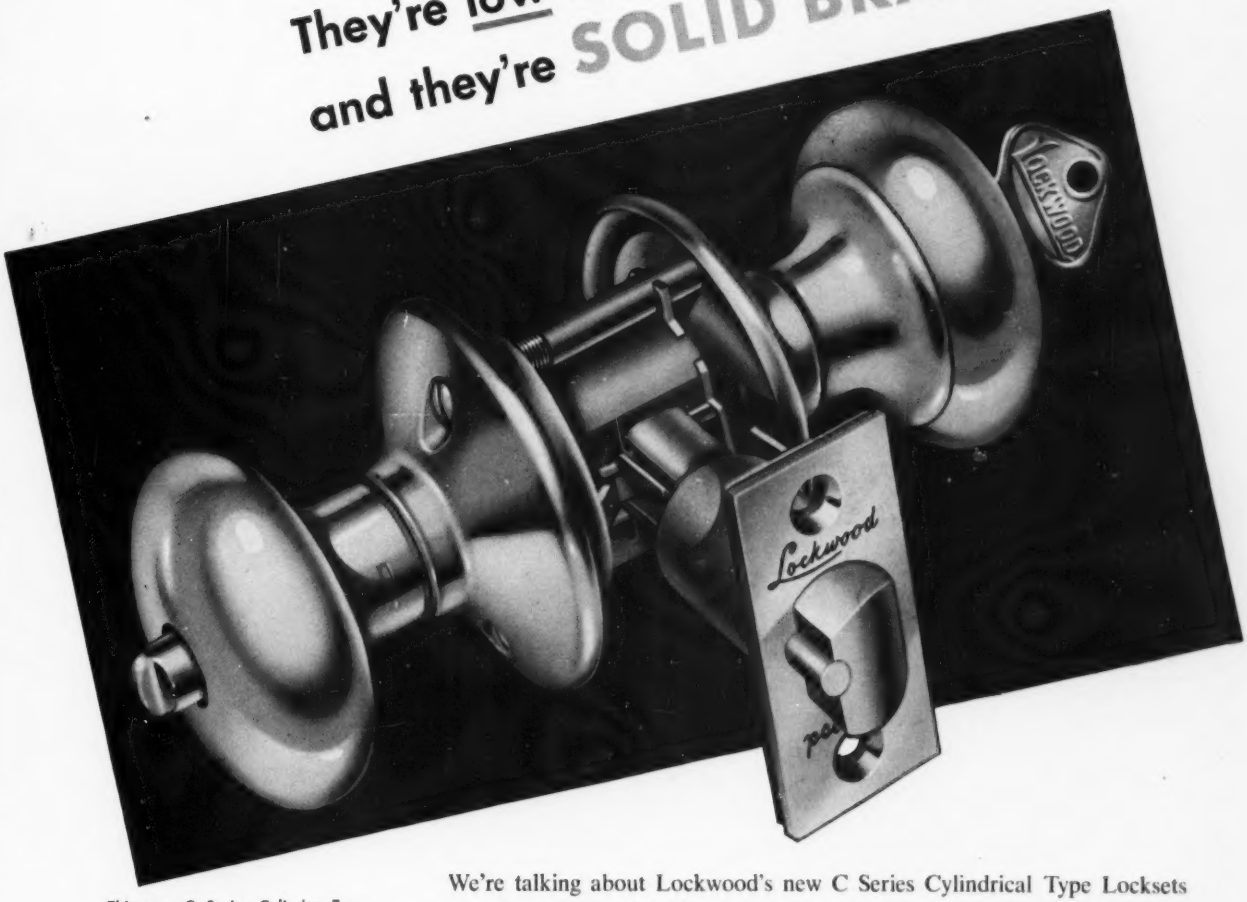

This new C Series Cylinder Type Lockset is made by Lockwood Hardware Mfg. Co., Fitchburg, Mass., Division of Independent Lock Company. Anaconda Metals in a variety of alloys were especially adapted to its "solid brass" construction.

We're talking about Lockwood's new C Series Cylindrical Type Locksets recently introduced to the trade. An entire new plant was built for their production.

Here, for the first time in Lockwood's history, ease-of-installation, ruggedness, smooth operation, outstanding design and long life were engineered into a lockset in one fell swoop, aimed specifically at the low-price field.

Time-tested brass is used in every wear-and-weather-vulnerable spot: turnbutton, knobs, knob shanks and inserts, roses, latchplate, auxiliary locking plunger – right down to the pins, springs, tumblers and extruded shell of the cylinder lock.

It took a bit of doing to determine the right Anaconda Copper Alloy, in just the right temper, gage and grain size for each of the several different functions and fabricating operations involved. But then, that's been the business of The American Brass Company for a long time. Maybe we can be of service to you? Address: The American Brass Company, General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

8389

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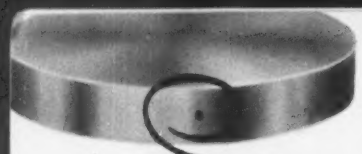
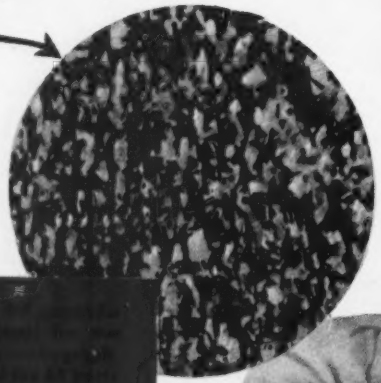
Made by The American Brass Company

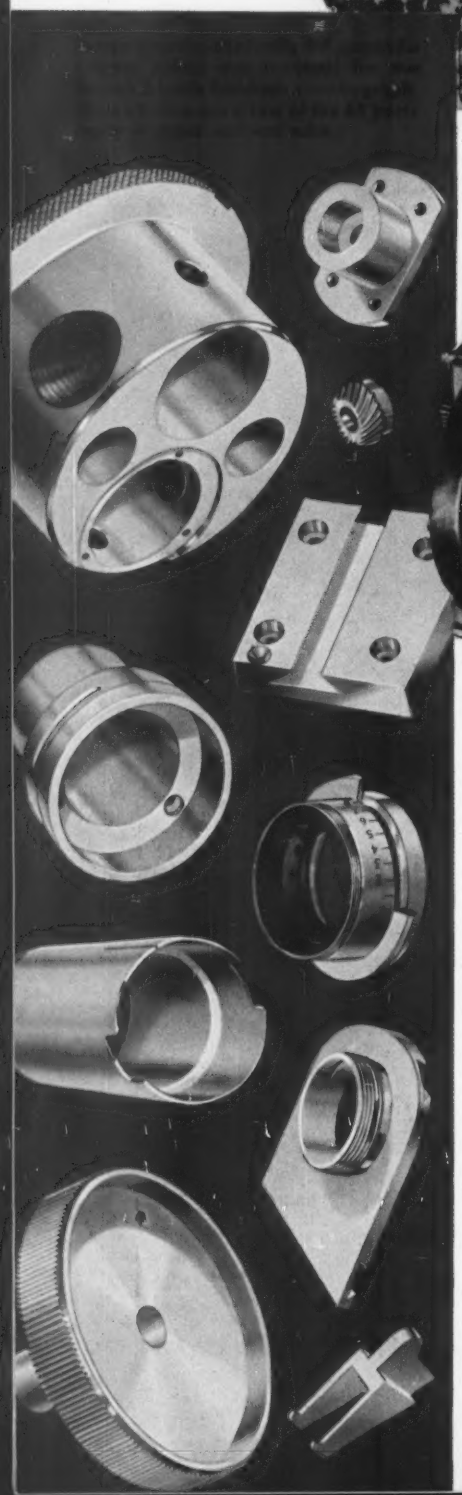
to Bausch & Lomb:

may the second 100 years be as productive as the first!





HERE ARE TWO PICTURES OF THE SAME THING . . . above a section of Tobin Bronze* Rod. At right a micrograph at 75 diameters of a polished and etched specimen cut from the rod. *Reg. U. S. Pat. Off.



To Bausch & Lomb Optical Co., which this year is celebrating its 100th anniversary of manufacturing fine optical instruments, America owes a debt of thanks. Through its development of scientific equipment, this pioneer optical firm has helped American science and industry to apply modern precision methods to research and production.

One example of fine Bausch & Lomb industrial optical equipment is the B&L Research Metallograph. With this precision instrument a skilled laboratory technician may examine and photograph metal structure at high magnification. To build it Bausch & Lomb uses 61 parts made of seven Anaconda Copper Alloys. Eight parts are formed from tube, 16 from strip and 37 from rod. Of what advantage are these alloys? They provide accurate, smooth surfaces on delicate working parts. They lead to production economies through higher machining speeds and longer tool life.

With such a variety of wrought forms available, there's little wonder that so many instrument makers depend on copper alloys . . . from the mills of The Americn Brass Company. General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. B3B9

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Play safe! Pass the buck! Ask *us* to stick *our* necks out for the Fractional Horsepower Gearing you need. Lots of careful buyers do this. They call in our competent engineers *early in the drawing board stage.* That's the time to establish . . 1. Design, 2. Material, 3. Manufacturing tolerances and economies, 4. Costs that fit your budget, 5. Deliveries to meet your production schedules.

Here at Small Gearing Headquarters you get all the advantages developed through 35 years of *specialization* . . years of perfecting men, methods, machines and inspection to highest standards of accuracy. So, whenever Small Gearing is involved, it's just good business to *"put it up to G.S."*. You'll get the kind of friendly, helpful service you've always wanted.

FRACTIONAL HORSEPOWER

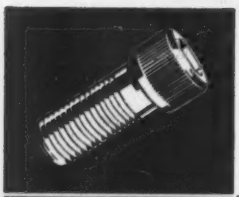
GEAR
Specialties, Inc.
2635 WEST MEDILL AVENUE
CHICAGO 47, ILLINOIS

SPURS • SPIRALS • HELICALS • BEVELS • INTERNALS
WORM GEARING • RACKS • THREAD GRINDING

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS
OF FRACTIONAL HORSEPOWER GEARING

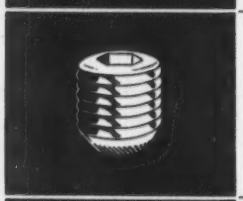
You'll save time and money by using UNBRAKO®

Time—because your local UNBRAKO distributor carries a complete stock of these close tolerance fasteners, and deliveries are prompt. Money—because it is possible in many cases to drill and tap fewer holes, use fewer screws, when you fasten assemblies with UNBRAKOS. Ask your local UNBRAKO distributor for a copy of UNBRAKO Standards or write SPS, Jenkintown 19, Pa.



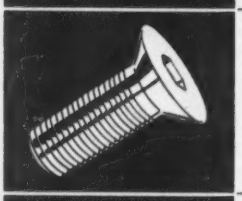
SOCKET HEAD CAP SCREWS

- Knurled head for sure finger grip and fast assembly
- Accurate hex socket for positive nonslip internal wrenching
- Heat treated alloy steel, controlled fillet and continuous grain flow for strength
- Fully formed threads—Class 3 fit
- Standard sizes—#4 to 1"



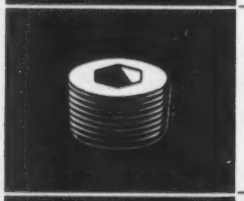
SELF-LOCKING SOCKET SET SCREWS

- Knurled cup point, for positive self-locking, won't work loose
- Accurate hex socket for nonslip internal wrenching
- Fully formed threads—Class 3 fit
- Heat treated alloy steel for strength
- Standard sizes—#4 to 1"



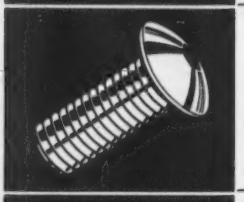
FLAT HEAD SOCKET CAP SCREWS

- Designed for flush head assembly of thin section materials
- Heat treated alloy steel for strength
- Uniform 82° angle under head for maximum contact
- Accurate hex socket for positive, nonslip internal wrenching
- Fully formed threads—Class 3 fit
- Standard sizes—#4 to ¾"



DRYSEAL-THREAD PRESSURE PLUGS

- Fully formed threads for positive sealing without compound
- Heat treated alloy steel for strength
- Continuous grain structure for stronger threads
- Controlled chamfer for faster starting of threads
- Accurate hex socket for nonslip internal wrenching
- Standard sizes—1/16" to 1¼" National Pipe Thread Fuel

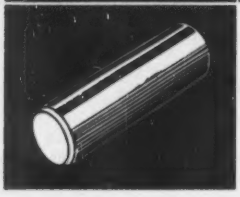


BUTTON HEAD SOCKET SCREWS

- Designed for applications where countersinking is not practicable
- Heat treated alloy steel for strength
- Low head height for streamlining designs
- Accurate hex socket for nonslip drive and freedom from marred or mutilated heads
- Fully formed threads—Class 3 fit
- Standard sizes—#8 through ⅝", inclusive

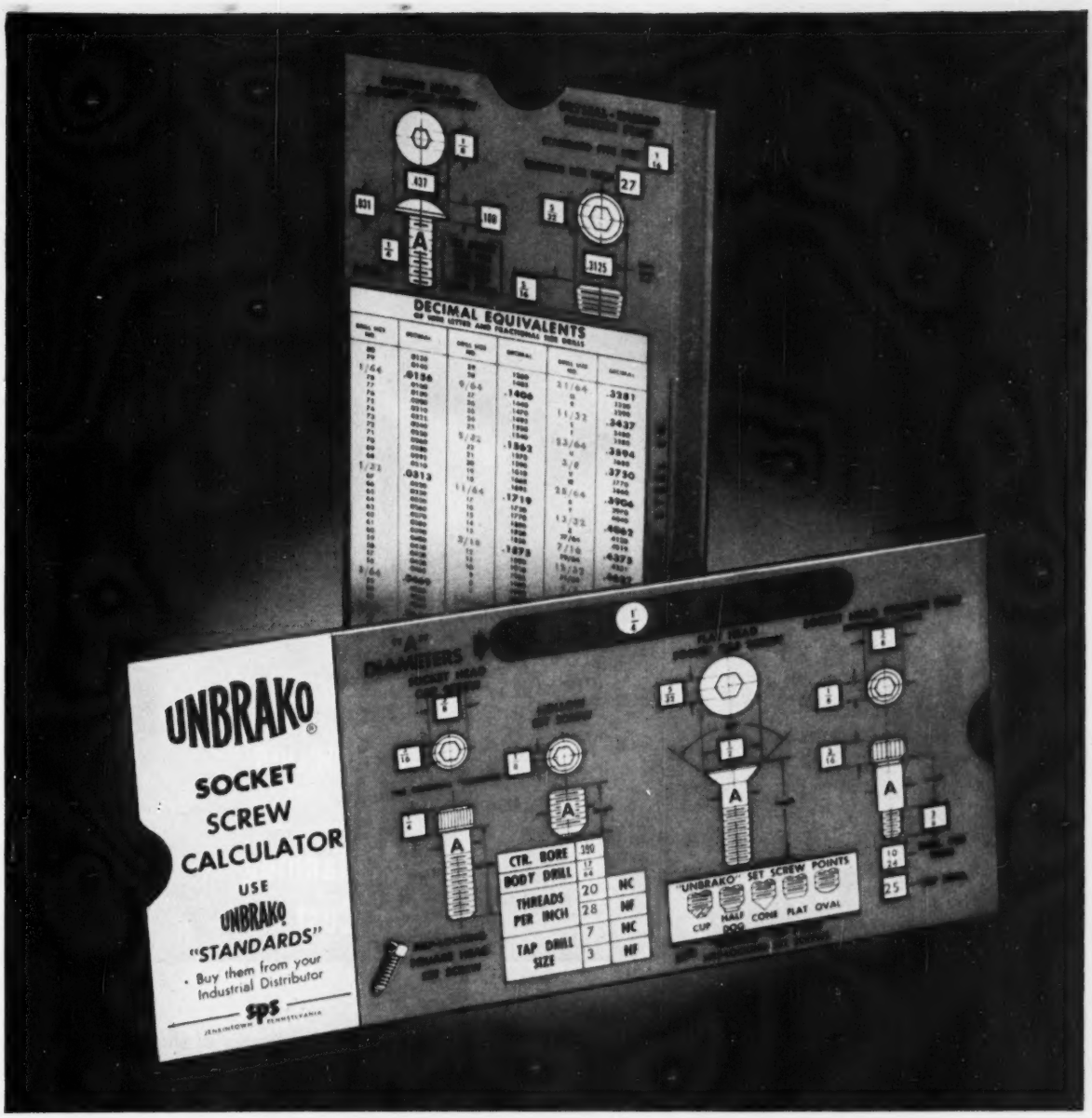
SHOULDER SCREWS OR STRIPPER BOLTS

- Heat treated alloy steel for strength
- Knurled head for sure finger grip and fast assembly
- Accurate hex socket for positive internal wrenching
- Shoulders held to unusually fine tolerances for close fit
- Threads and head concentric with the body for uniformly accurate assembly
- Finished threads close to the shoulder for holding power
- Fully formed threads—Class 3 fit
- Standard sizes—¼" to ¾"



PRECISION GROUND DOWEL PINS

- Formed ends, with continuous grain flow, won't chip
- Surface hardness, Rockwell "C" Scale: 60-62
- Surface finish: 6 microinch maximum
- Core hardness, Rockwell "C" Scale: 50-54
- Average single shear strength: 150,000 psi
- Diameter tolerance: +0.0001"
- 2 standards—blue label pins .0002" oversize to meet nominal press fit requirements; red label pins .001" oversize for use as repair pins



Our New UNBRAKO Socket Screw Calculator—YOURS FOR THE ASKING

This handy pocket-sized slide-rule type socket screw calculator gives diameters, lengths, socket dimensions, threads and drill sizes—in fact, everything you want to know when using UNBRAKO socket screw products. And it's free.

Ask your UNBRAKO distributor, or write to SPS, Jenkintown 19, Pa.

UNBRAKO®

Standard UNBRAKOS *sold by leading industrial distributors everywhere.*

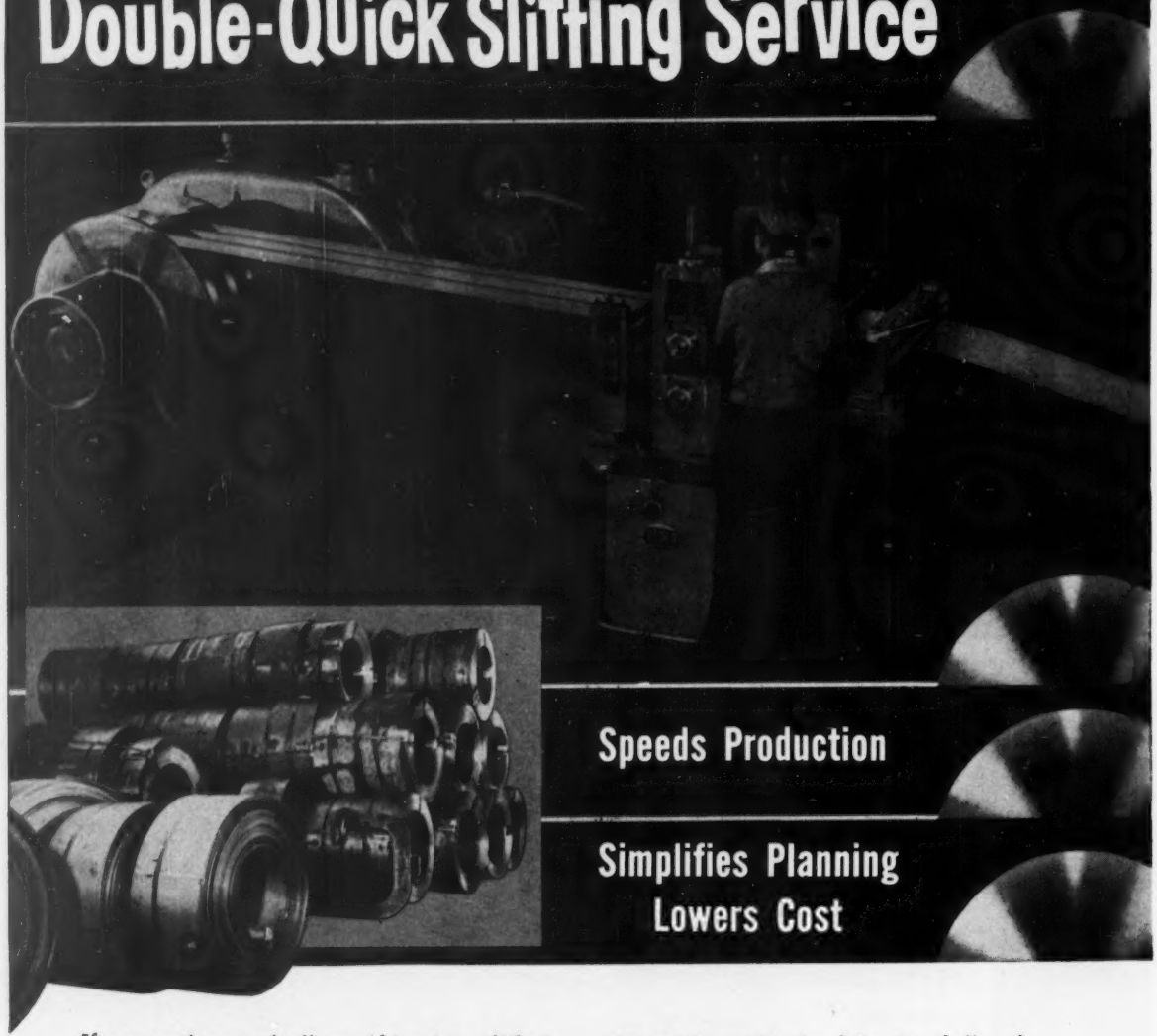
SOCKET SCREW DIVISION

Our Fiftieth Year : A START FOR THE FUTURE

SPS
JENKINTOWN PENNSYLVANIA

Self-Locking Set Screws • Flat Head Cap Screws • Shoulder Screws • Knurled Head Cap Screws • Dowel Pins • Button Head Socket Screws

Double-Quick Slitting Service



Speeds Production

Simplifies Planning
Lowers Cost

If your requirements in slit-to-width strip are difficult to anticipate weeks or months in advance; if deliveries are slow and uncertain; if sources of slit strip supply are limited—a Yoder slitter may be the perfect answer to all these handicaps.

Aside from the great CONVENIENCE of being able to supply, on a few hours notice, your own needs in slit-to-width strip, from a relative small stock of standard-width coils, the *economies* effected are surprisingly great: First, by a substantial reduction in the price per ton; secondly, by elimination of idle time while waiting for deliveries of slit strip.

Your tonnage requirements, therefore, *need be no more than 100 tons per month (for narrow strands, much less) in order to make the slitter an exceedingly profitable investment.*

Yoder slitters and accessories are made in all sizes and types, for sheets as well as coils, small and large; narrow as well as wide strands; all gauges.

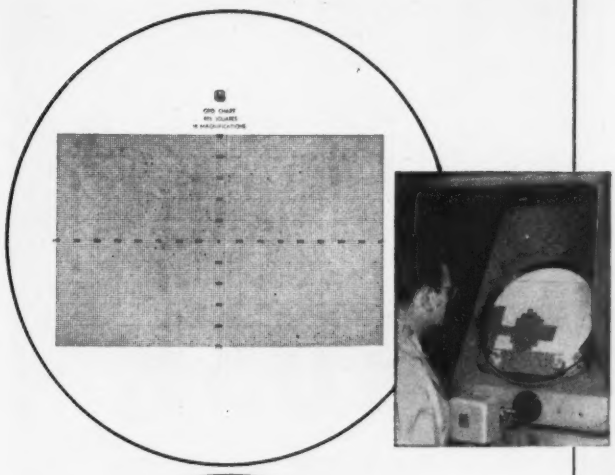
The Yoder Slitter Book is a practical treatise on the economics and mechanics of slitter operation. Send for it.

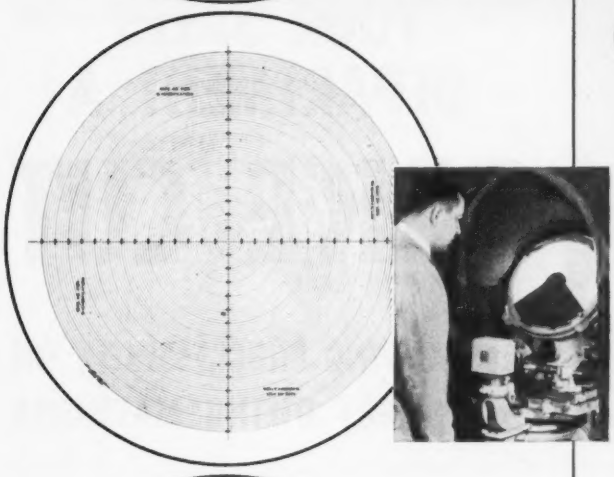
THE YODER COMPANY • 5504 Walworth Avenue, Cleveland 2, Ohio

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS—cold forming and welding

ENGINEERING YODER MANUFACTURING





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Comparator Charts

With these charts many ***Difficult Inspection Operations Become Routine Jobs.***

They are ***Invaluable Accessories*** that ***Add*** to the ***Economy*** and ***Versatility*** of the ***Comparator.***

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Made To Precision Standards Of Accuracy established during more than ***30 Years Of Specialized Optical Experience.***

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JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

OPTICAL COMPARATOR DIV.

RUSH YOUR SALES DEPARTMENT A PRICE CUT

DO YOUR STAMPING PROGRESSIVELY ON HENRY & WRIGHT DIEING MACHINES

Figure it out. If you could produce dozens of different jobs on one press . . . if you could combine separate operations into one progressive sequence . . . if you could improve accuracy, get higher speeds with longer die life . . . and yet grind less metal off the die to sharpen it . . .

If you could get these cost-cutting, labor-saving, inspection-reducing benefits, you wouldn't wonder whether you could afford a Henry & Wright Dieing Machine now. You'd decide, "How can I afford to be without it now?" Well, let's talk serious business, because those are just the benefits everyone gets with Henry & Wright Dieing Machines —and, brother, how the Sales Department will love that price cut you'll give them.

HENRY & WRIGHT DIEING MACHINES . . . A PROFIT WITH EVERY STROKE

Only the best is good enough

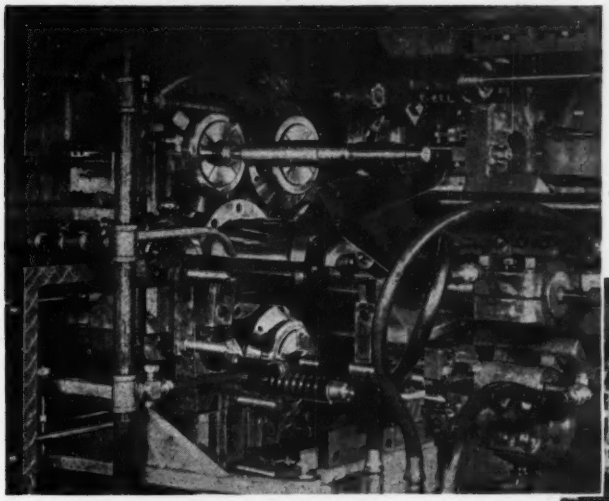
H&W

HENRY & WRIGHT

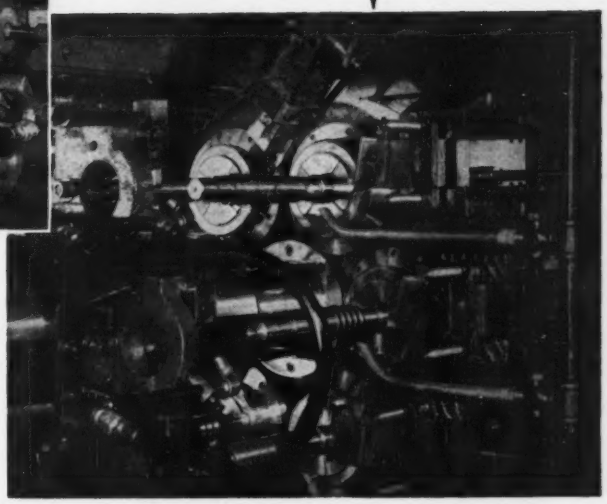
DIVISION OF EMHART MFG. CO.

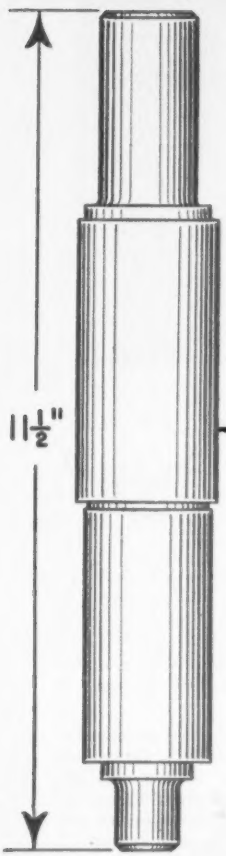
HARTFORD 1, CONNECTICUT

NEW CATALOG Get up-to-the-minute facts on Dieing Machines — capacities range from 25 tons to 2500 tons. Write Henry & Wright, 461 Windsor St., Hartford, Conn.



Tooling Area 3½-SIX
Front Side *Rear Side*





Automotive Transmission Shaft

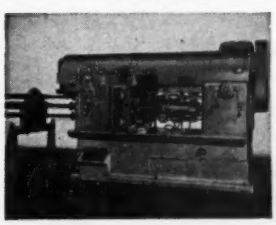
A very good reason why CONOMATICS handle a wider variety of machining operations per single chucking is their greater number of tooling positions.

WITH MORE TO SELL THERE'S MORE TO TELL

Whether you're selecting a new golf club, motor car, or multiple spindle bar automatic, you want what best fits into the "scheme of things."

Before you can be sure that any product will meet your requirements you must have information. And you can judge only by that at hand or available. Complete information lets *you* decide what's important to *you.* That's as it should be.

There's always more information to be had about the product that has more to offer. It's that way about CONOMATICS. And you can always have *complete* information. If you will write, wire, or phone, you can have it now.



Conomatic CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

Single spindle 1800 Series Frauenthal Grinder, specially engineered for grinding Diesel engine connecting rods . . . typical of numerous operations where the workpiece is large and cumbersome but hole to be ground is relatively small.

. . . another "MILLIONTHS-of-an-inch" Frauenthal Grinder

IT'S the extreme precision to which Frauenthal Grinders work that surprises metalworking leaders who know the potentials of modern speed-and-precision machines. You will be surprised, too, at the savings in time and money you can make with these super-precision grinders!

In both toolroom and production set-ups, simultaneous grinding of inside or outside and faces . . . or boring and turning . . . can now be held to such close precision of parallelism and concentricity that measurements of tolerance get down to *fractions-of-ten-thousandths*, best expressed in *millionths* of an inch!

Manufacturers of precision parts for aircraft, jet and automotive engines, tanks, gunmounts, radar units, Diesel connecting rods, plug valves, high precision bearings and other industrial and military parts and assemblies find Frauenthal Grinders profitable investments. You are sure of utmost precision, unfailing interchangeability and speedy, dependable production with these "millionths-of-an-inch" grinders.

Series 1800 available in 4 standard sizes, with 30", 36", 42", or 48" tables and 60" maximum swing. Specially engineered features can be included to fit your requirements.

Frauenthal
MULTIPLE-HEAD SUPER-PRECISION CYLINDRICAL **Grinders**
PRECISION-GRIND INSIDE, OUTSIDE AND FACES SIMULTANEOUSLY TO MILLIONTHS OF AN INCH!

write for bulletin

Frauenthal Division
THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN

SO YOU DON'T NEED GAGES?

Here is a job where cylindrical Plug Gages are saving man hours.

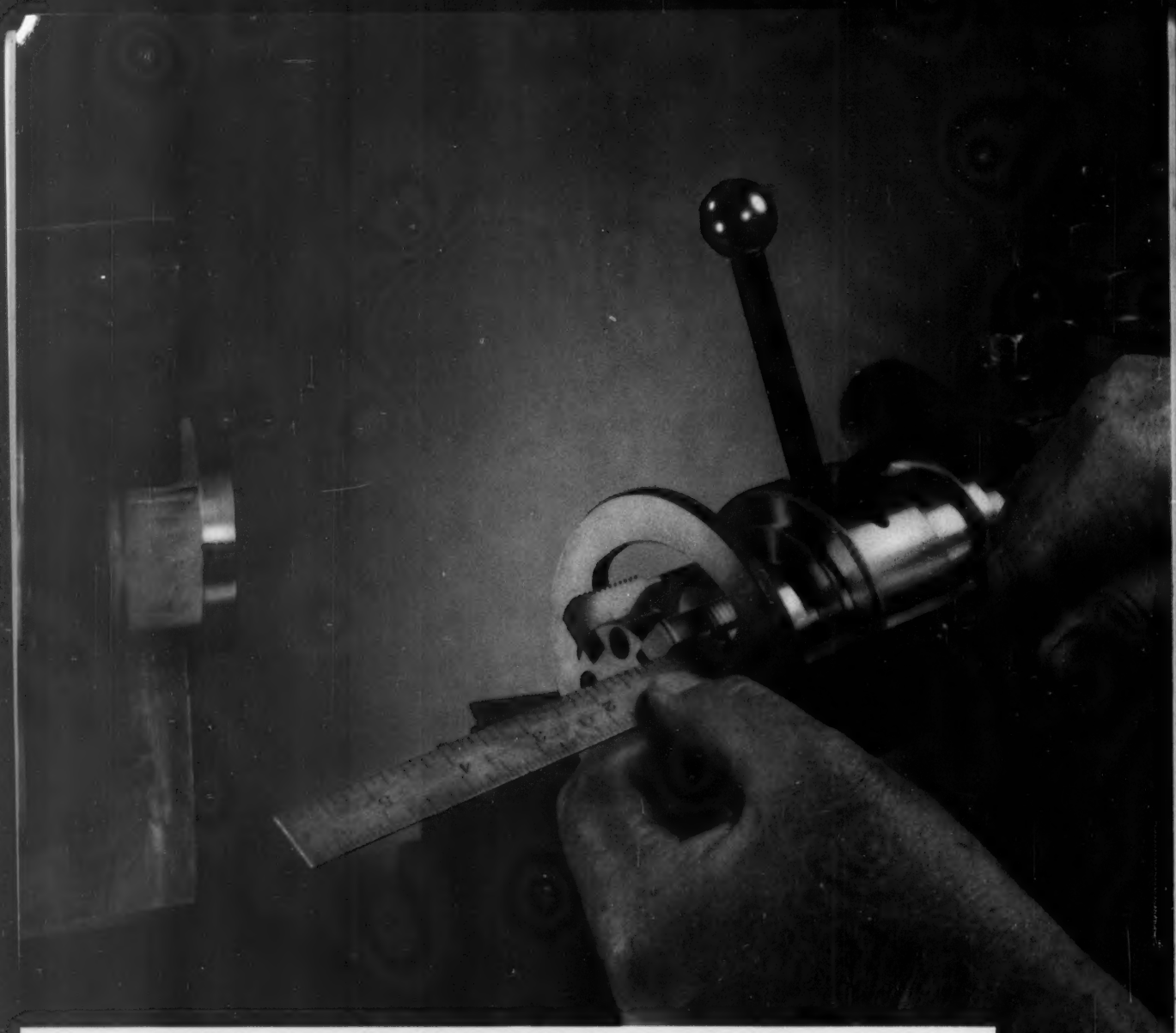
These plated brace "sweeps" will go from here to final assembly.

Formerly final assembly involved a lot of selection and fitting. Now, thanks to this gaging operation, the final assemblers *know* they'll fit. No more selection — no more fitting — yet faster assembly.

Got a job that "Don't need Gages"? Let us survey it for you without obligation, it may save you money.

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS.



UNIFORM THREADING DEPTH ASSURED!

Here is a GEOMETRIC Collapsing Tap with Ground Thread Chasers and Trip plate that collapses chasers instantly for positive uniformity of thread depth.

These all-purpose universal taps made in eleven sizes will handle practically any tapping job $1\frac{5}{16}$" to $8\frac{1}{2}$" actual diameter — also taper and straight pipe threads. Can be used on most standard machines, both rotary and stationary, without additional parts.

Fast and accurate adjustment by means of positive trip bar binding, ample chip space, and a full flow of coolant to the chasers are popular features among users.

Write for full details. Specify Bulletin S

Greenfield Tap and Die Corporation

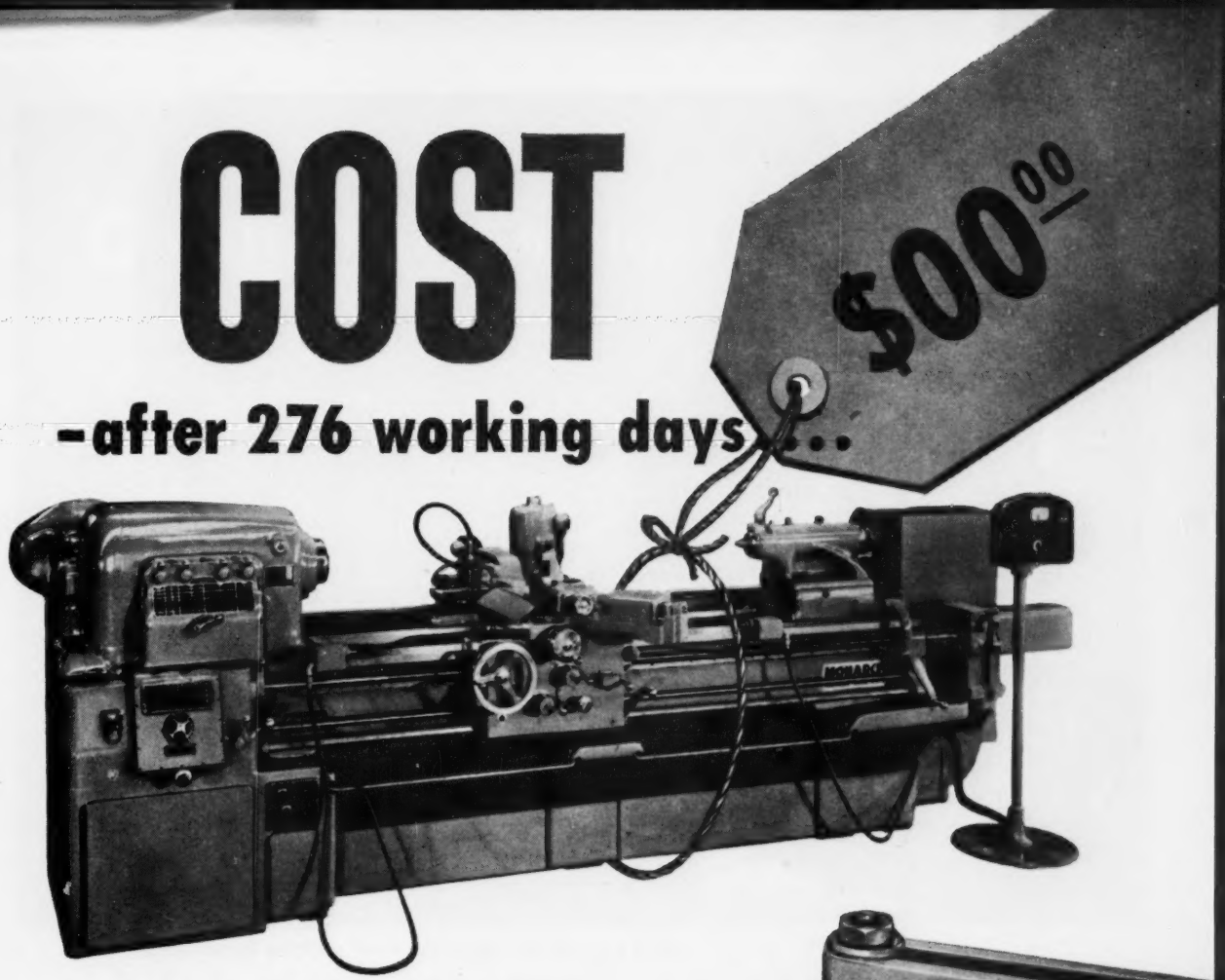
GEOMETRIC TOOL COMPANY DIVISION

NEW HAVEN 15, CONNECTICUT

GEO MET RIC

COST

-after 276 working days...



IT WROTE OFF ITS COST IN 10½ MONTHS!

This report comes from a well-known machine tool manufacturer (not us!). We can show you many similar ones from all kinds of plants. They all add up to one incontrovertible fact—Monarch Air-Gage Tracer controlled, fully automatic turning, with its single running tool, delivers output at top efficiency. Why not? Look how many ways it saves! In turning time. In setup time. In tooling time and costs. In subsequent grinding. It's true of short runs as well as long ones.

The Monarch Air-Gage Tracer is known everywhere for its superb accuracy of duplication. The swiveling type used here adds to this accuracy an amazing versatility. Apply it to our 20 x 72 Series 60 Lathe and add the Autocycle Control as above, and you have the shop man's dream come true—the ultimate in versatility *plus* fully automatic operation.

This manufacturer, after only brief experience with his Series 60, quickly added a 20 x 168 Model M Heavy Duty Lathe with similar equipment. Together, using round templates, these machines are delivering automatic output of over 600 jobs!

The Air-Gage Tracer is right! Its performance is right! Why don't *you* write—for complete information? Request Booklet #2606 and mention your specific requirements.... *The Monarch Machine Tool Company, Sidney, Ohio.*

HERE'S HOW!

. . . And by the user's own figures! This lathe was bought to turn 20 to 25 jobs. It proved so versatile that, with the larger Model M, it's now turning 600. Time savings vary from job to job, but here's a sample. One difficult work piece used to require 3½ hours' turning. It's turned now—in lots of 24—in 10 min. per piece. Each *lot* in only slightly more time than it used to take for each *piece!*

Monarch

ACCURACY • ECONOMY • LONG LIFE

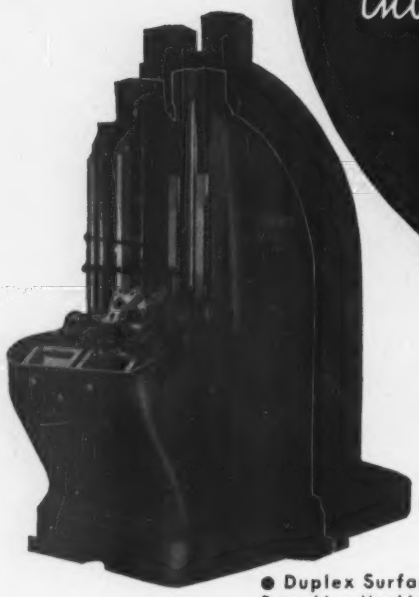
TURNING MACHINES

• • • • • • FOR A GOOD TURN FASTER • • • • • • TURN TO MONARCH • • • • • •

FOR HIGHER PRODUCTION

investigate...

surface broaching
for difficult
machine work



● Duplex Surface Broaching Machine. Made in 5, 10, 15, and 25 Ton Sizes.

● Many types of work can be surface broached on Footburt machines at remarkable savings over previous machining methods. High production is obtained with required accuracy and finish. Holding fixtures are designed for quick, convenient loading. Cutting tool maintenance costs are low. We will be glad to work with you on the application of surface broaching.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio
Detroit Office: General Motors Building

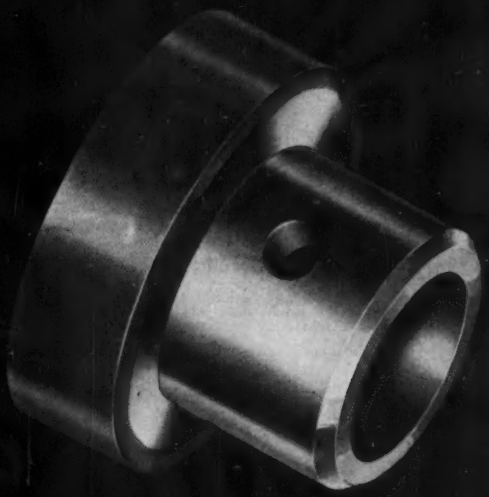
● Single Slide Surface Broaching Machine. Made in 5, 10, 15, and 25 Ton Sizes.

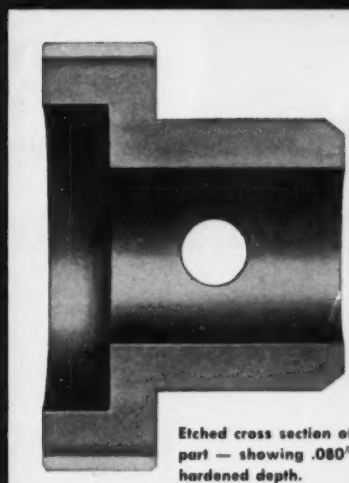
● Continuous Type Broaching Machine. Made in 4 Sizes.

FOOTBURT

SURFACE BROACHING

COSTS CUT 94%





Etched cross section of part — showing .080" hardened depth.

with TOCCO* Induction Heating

A cost reduction of 94% resulted when heat-treatment of this Corn Harvester part was changed from carburizing to TOCCO-hardening. Look at the unit cost breakdown:

CARBURIZING		TOCCO-*Hardening*	
Degrease	$0.0020	*eliminated*	
Carburize	0.0200	*eliminated*	
1st quench	0.0150	TOCCO, heat and quench	$0.0060
2nd quench	0.0150	*eliminated*	
Draw	0.0050	*eliminated (self-draw)*	
Shotblast	0.0035	*eliminated*	
Internal Grind	0.0243	*eliminated*	
External Grind	0.0166	*eliminated*	
	$0.1014		$0.0060

"—Savings of 9½ cents per piece—$4770.00 on each 50,000 piece batch, *plus* an hourly production increase from 120 to 300 pieces per hour, *plus* improved quality of the product by virtue of the deeper case and stronger core."

Have you investigated TOCCO's cost-savings possibilities for your hardening, brazing, melting or forging operations? Why not write us today or send blueprints of your parts —no obligation, of course.

THE OHIO CRANKSHAFT COMPANY

TOCCO

Mail Coupon Today

NEW **FREE** BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-6, Cleveland 1, Ohio

Please send copy of "A TOCCO Plant Survey—Your Profit Possibility for 1953".

Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____

half the time with Heller NUCUT wavy teeth Coarse, fine and extra-fine teeth all combined on one file for fast, deep, double-action cutting. Even, scratch-free finish. No chattering. Longer file life. **ORDER FROM YOUR LOCAL DISTRIBUTOR**

American-Swiss
VIXEN **NUCUT**

THESE THREE FAMOUS FILES ARE MADE ONLY BY HELLER BROTHERS

HELLER BROTHERS COMPANY
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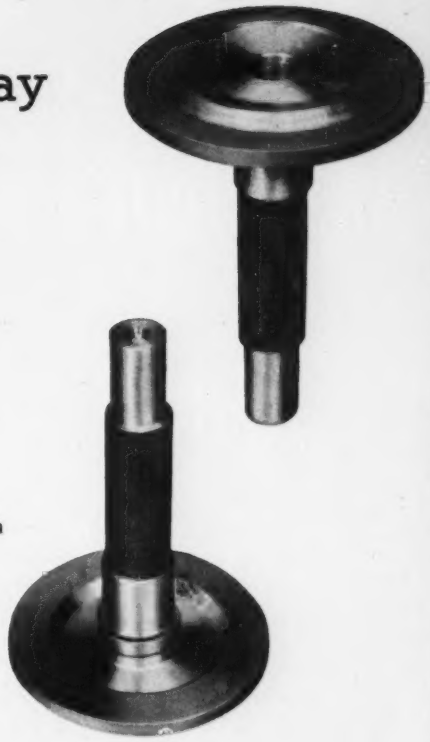
NEWCOMERSTOWN, OHIO

It took ~~120~~ 29 seconds the ~~old~~ new way



This 5" diam. forged torque converter shaft requires high precision counterbored sections on the outside and inside flange faces.

Previously these operations were done on machines using high speed cutting tools. Two men working at two machines without automatic control of the time cycle performed the operations cited in average time of about 120 seconds each. This method presented quite a problem in *tolerances, time* and *cost.* Then along came the—

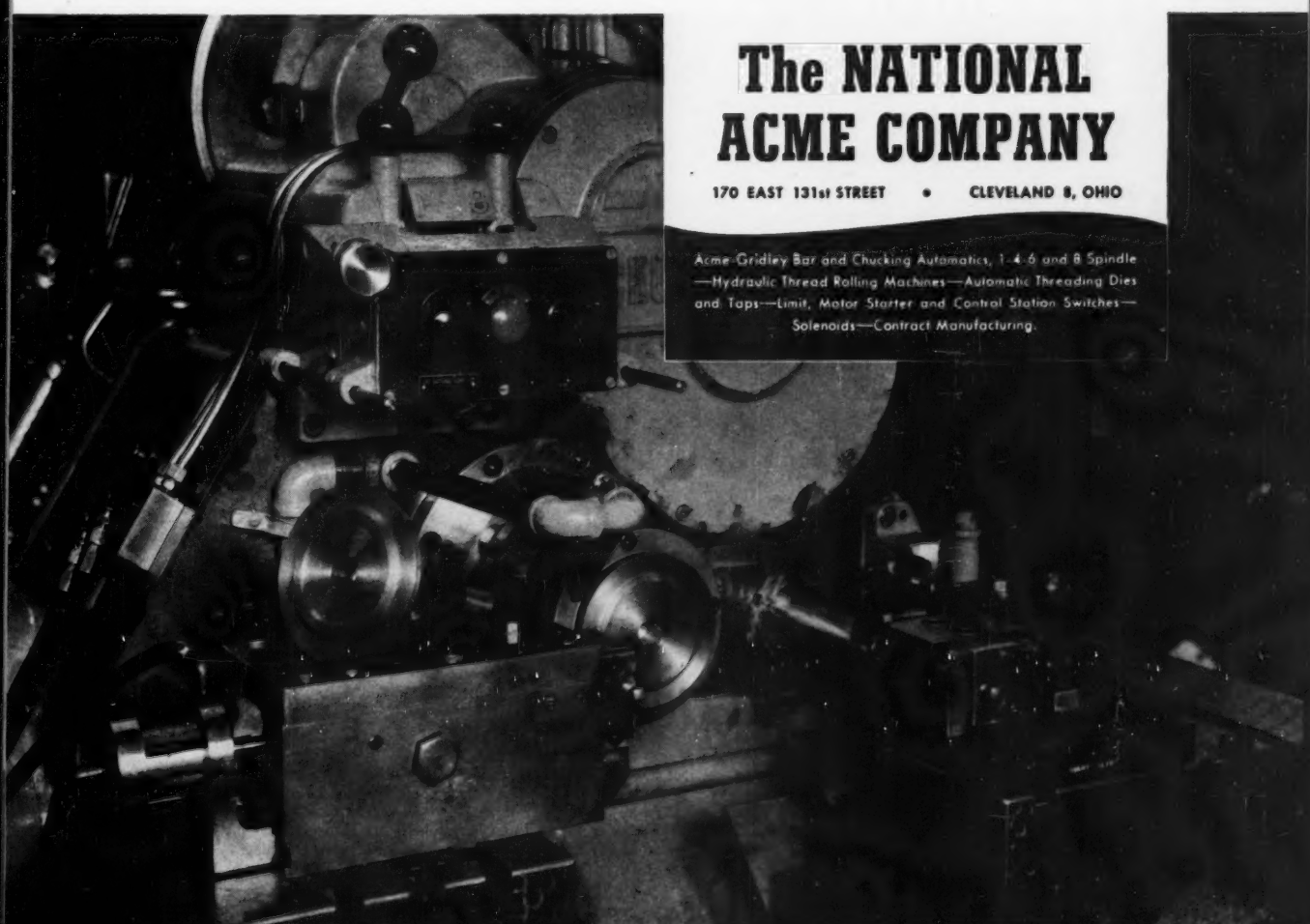
ACME-GRIDLEY CHUCK-MATIC } *the powerful 12" single-spindle automatic chucking machine*

Two of these Chuck-Matics are now placed side by side, one for counterboring the outside of the flange, the other for the inside. Both employ carbide tipped tools—for cuts as fast as tools can take it; both operate at the definitely controlled cycle time of 29 seconds, and *one man runs both machines.* These facts account for the 4 times faster output.

If you have a chucking problem of tolerances, time, man hours and costs, ask our engineers to show yours how the Chuck-Matic can help solve it—Bulletin SC-46.

REMEMBER: *Industry can't do* **TODAY'S** *job . . . with* **YESTERDAY'S** *tools—and be in business* **TOMORROW.**

Counterboring outside face of flange on 12" Acme-Gridley Chuck-Matic



The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics, 1-4-6 and 8 Spindle —Hydraulic Thread Rolling Machines—Automatic Threading Dies and Taps—Limit, Motor Starter and Control Station Switches—Solenoids—Contract Manufacturing.

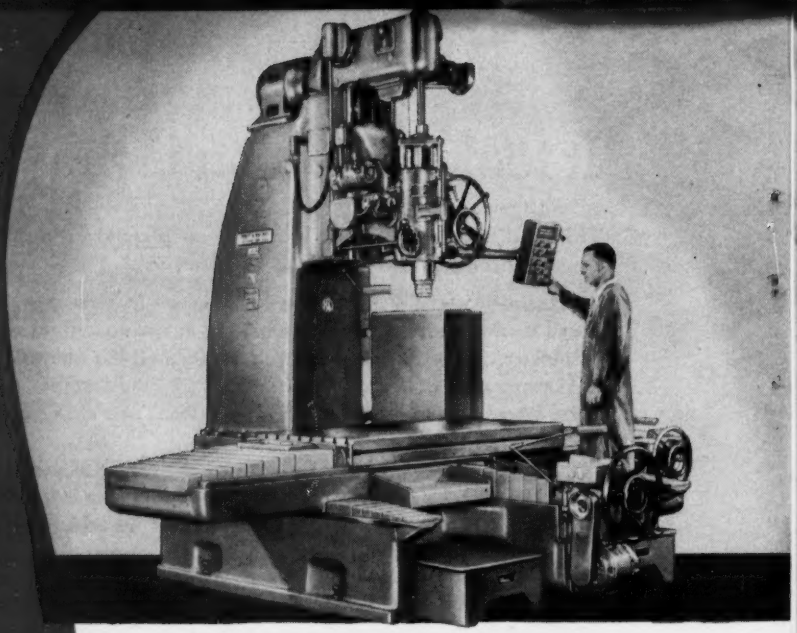
Whatever Your Needs...

THE

PRATT & WHITNEY MAN

who calls on YOU

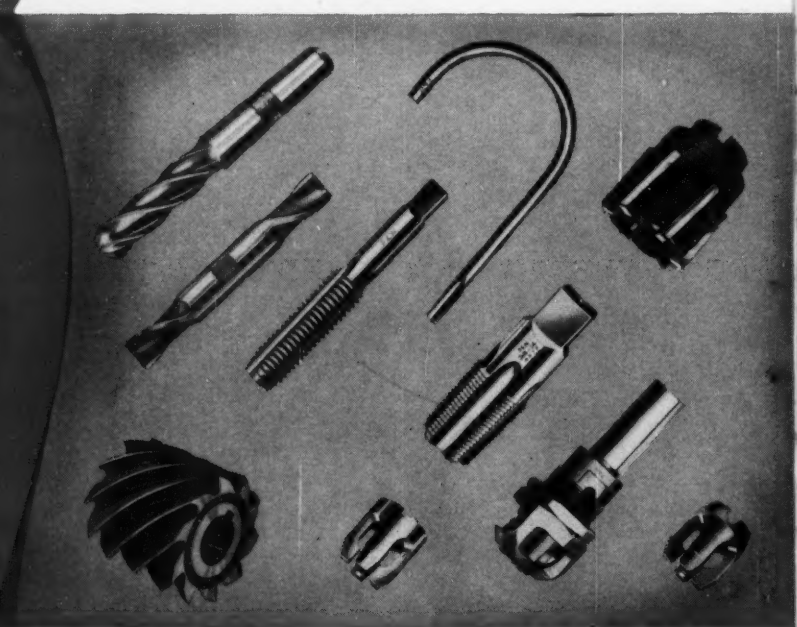
Knows His Stuff!



If it's Machine Tools

like the Pratt & Whitney 4E *"Electrolimit"* Jig Borer

You'll be making the "First Choice for Accuracy" when you call in Pratt & Whitney. The P&W Representative is a trained specialist in machine tools . . . machine tools that will bring tool room standards of accuracy to your production line. Don't settle for less when straight-line, factory-direct skill and knowledge are yours for the asking.

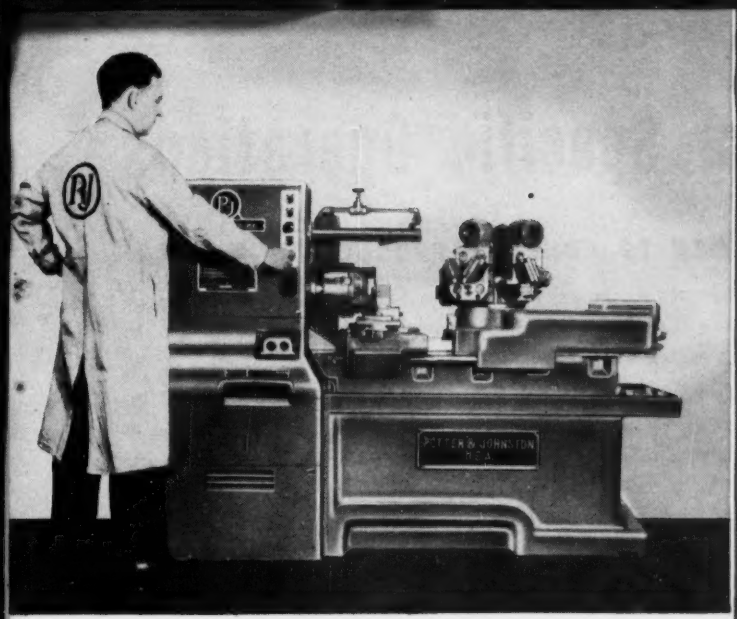


If it's Cutting Tools

there's the best for every job in the complete P&W Line

Talk to the man who talks your language . . . the Pratt & Whitney factory-trained cutting tool specialist. In direct contact with the factory and the rest of the P&W family of specialists, he places a wealth of knowledge at your disposal. From start to finish, you're way ahead of the game when you call in Pratt & Whitney.

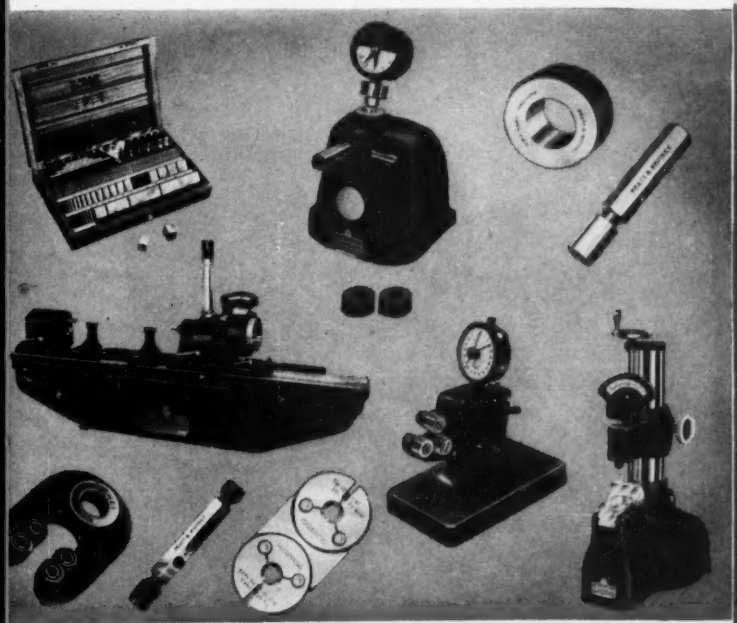
Pratt & Whitney Branch Offices maintain comprehensive



If it's Automatics PLUS Tooling

like the Potter & Johnston Automatic Turret Lathe

When profitable production calls for a high output of precision parts, you can help yourself to greater speed, accuracy and economy with a call to your Pratt & Whitney-P & J Representative. Thoroughly experienced in practical manufacturing problems . . . and working closely and constantly with our factory engineers, he'll make sure that you get the P&J Machines *plus* P&J Tooling best for your specific needs.



If it's Gages to maintain the master and working standards in Industry

The Pratt & Whitney Man you'll talk to is a Gage specialist who represents a Company which manufactures a great variety of gages and gaging equipment. When he recommends the *right* gage for *your* job, you can be sure he's thinking about *your* problem . . . not merely trying to sell the only thing he has to offer from a limited line. In every gaging problem, there's one type of P&W Gage that does the job better than any other . . . and that's what he'll recommend.

stocks of regularly listed Cutting Tools and Gages.

Wherever You Are

THE PRATT & WHITNEY MAN is available WHEN you need him

. . . because he works out of the Pratt & Whitney Branch Office and Warehouse conveniently located near you. His expert advice is as near as your telephone . . . and comprehensive stocks of Pratt & Whitney Cutting Tools and Gages are available to meet your immediate needs.

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.

First Choice for Accuracy

Equipped Presses for Specific Operations

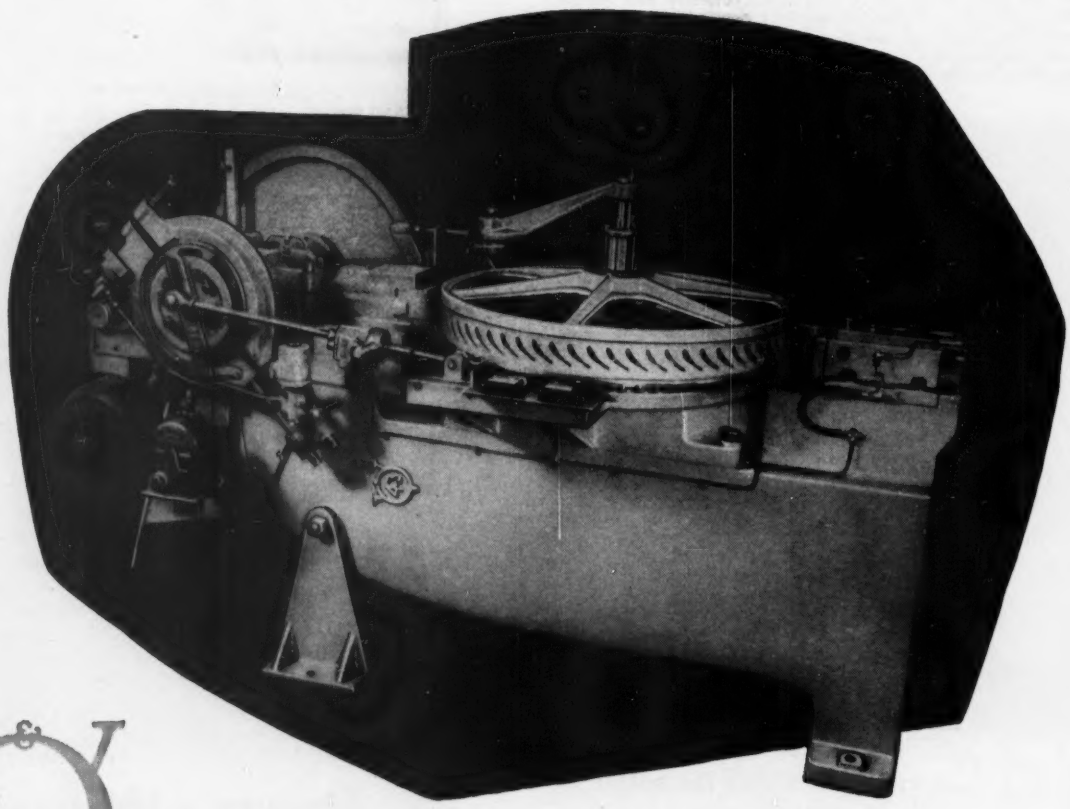
IT TAKES THREE MEN TO RUN ANY PRODUCTION MACHINE

A production machine has to have a set up man to get it running, an operator to run it, and a maintenance man to keep it running. And the design has to be right for all three men if quantity and quality of output are to be right.

For example, here is a V & O Equipped Press which has two slides to punch holes from the outside in, or from the inside out, of large diameter rings, for a controlled burr. The operations are all automatic except loading and unloading.

This press is laid on its back. With most of the moving parts in a horizontal plane the set up man finds it easy to index the mechanisms and adjust the dies, the operator has less trouble and fatigue in loading and unloading, and the maintenance man has everything visible and accessible.

Our representative would like to tell you about the special features by which other V & O Equipped Presses are solving specific production problems. He is right near you. Why not ask us to send him in?



THE V & O PRESS COMPANY DIVISION OF EMHART MFG. CO. **HUDSON, NEW YORK**

BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

"...and that is our Gear Department"

WE DOUBT that the photo of our plant hangs on many of our customers' walls. But we *do* serve as the "gear department" for many companies with both small and large gear requirements.

The benefits these customers enjoy might interest you. Working closely with you, all our facilities and personnel are at your service—trouble-shooting, designing, specifying, engineering, and manufacturing gears to meet your needs exactly. And behind these functions is the experience we have gained through almost forty years devoted exclusively to gear manufacture.

Of course, we sell to many manufacturers who make a portion of their own gear requirements, and shall always continue to do so. But for many companies, and perhaps yours is one, much may be gained by examining case histories of customers who refer to our company as their "gear department."

* * *

Write for our comprehensive catalog containing full information on the ten gear types in which we specialize.

AUTOMOTIVE GEAR WORKS, INC.

RICHMOND, INDIANA

DOUBLE DIAMOND GEARS

FOR FARM EQUIPMENT, AUTOMOTIVE & GENERAL INDUSTRIAL APPLICATIONS

DIALIZE and ECONOMIZE

Any AGD Adjustable Limit Snap Gage becomes a DIAL INDICATOR Snap Gage with a STANDARD Dializer

Patented

Simplicity Itself!...

By removing a pair of pins from the snap gage and inserting a STANDARD Dializer any make of AGD Snap Gage in any model, A, B or C, is instantly converted to a DIAL Snap Gage. Dializer is easily transferred from one frame to another.

Dializers are available for complete range of AGD Adjustable Limit Snap Gages (MODELS A, B or C)

No. 1 fits AGD Frames 1 thru 6
No. 2 fits AGD Frames 7 thru 10
No. 3 fits AGD Frames 11 thru 16

No. 3 Dializers also fit larger size frames beyond AGD size range (available from STANDARD) for dimensions up through 26⅝".

ACCURACY ASSURED by double reed principle.

RANGE OF ADJUSTMENT of gage is unaffected.

INDICATOR either with .0001" graduations and .005" range, or with .001" graduations and .025" range.

We can supply snap gage frames if you do not already have them. Tungsten carbide contact points, anvil blocks and snap gage pins are also available.

Write Today for Your Copy of Catalog C

Dialize Your LENGTH GAGES, too!

Dializers can also be used on any AGD Adjustable Limit Length Gage, Progressive Type for internal or external measurements.

STANDARD GAGE CO., Inc., Poughkeepsie, N.Y.

DoALL Replaces Production Tools As Soon As Better Ones Are Available

"The DoALL Company, world's largest manufacturer of band saw machines, and manufacturers of grinding machines, gages and cutting tools, replaces its manufacturing tools as fast as there are better ones available. We believe the wisdon of this management policy has proven itself beyond debate. Not only does this allow us to produce high quality at the lowest cost, but to carry out the basic premise of American progress.

"We feel that in management policy, industrial leaders must continually remind themselves of the basic formula of man's economic life. The only way mankind can improve its material well being is through the use of new and better tools. Everything that man sees, tastes or touches, starts out as a natural resource, and natural resources must first be conveyed or converted to become useful goods and services. The better the tools, the less muscular effort is expended by man, and the more goods available for himself and his neighbors. This is presented in its simplest form with the following formula:

Natural Resources	(plus)	Human Energy	(multiplied by)	Tools	(equals)	Man's Material Welfare
N R	+	H E	×	TOOLS	=	M M W

"The fantastic benefits of this process is demonstrated in the United States, where we are better off than the rest of the world because American industry has installed more and better tools per capita. The simple truth of this formula and the importance of tools is being realized not only by the non-technical men in management, but by political leaders throughout the world. Unfortunately, as yet, many politicians and many spokesmen of the press, and, many of our younger people are not yet aware of the fundamentals of this process which makes America great.

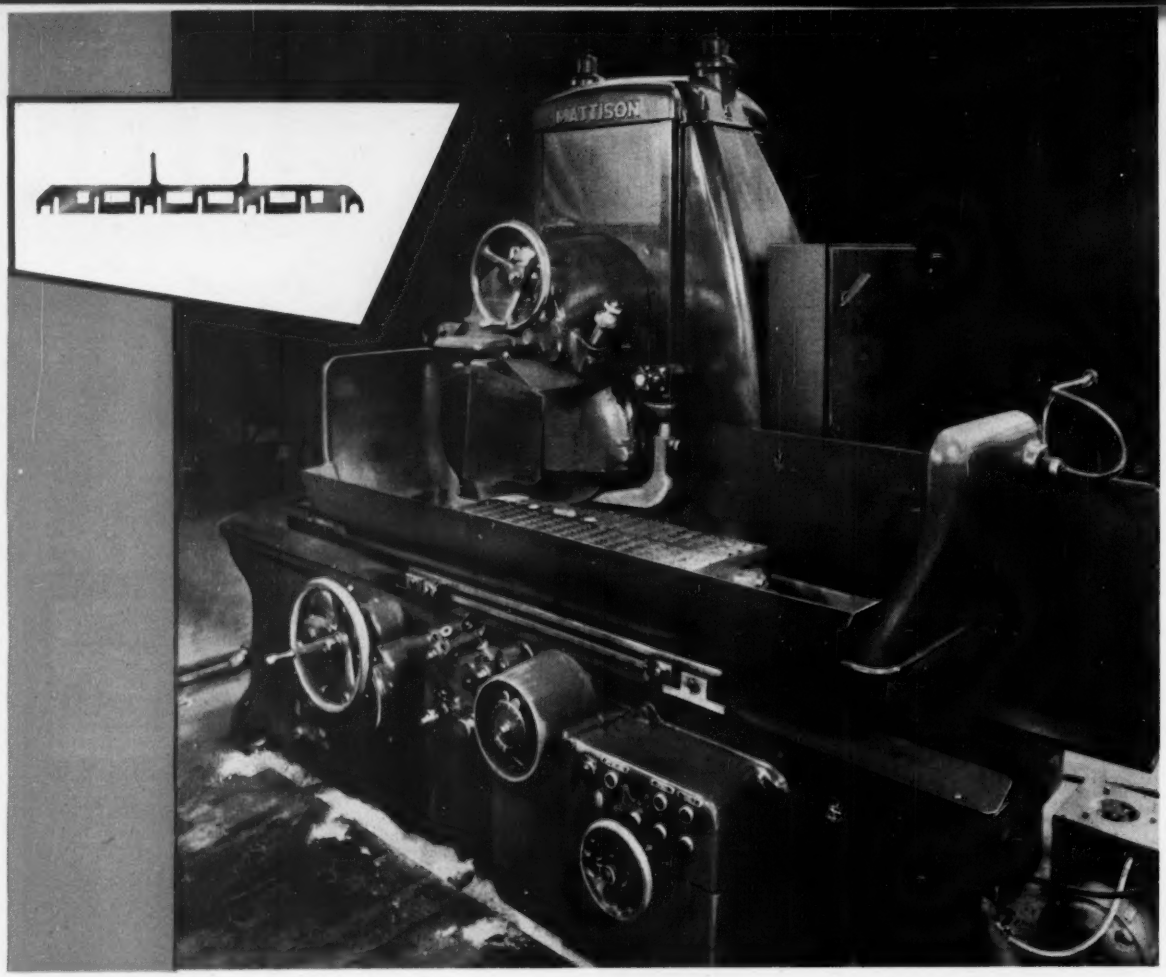
"Men of management who are closest to production are the best informed of the fabulous benefits that have accrued from this formula. Therefore, it is prudent for industry to champion education on the need for more and better tools because only by that route can we, or any country, have prosperity and progress."

LEIGHTON A. WILKIE, Chairman of the Board
THE DOALL COMPANY

ROCKFORD INSERT GROUP

Keep Gathering Metal-Working Production Ideas...Be Well Informed When The Time For Replacement Arrives . . . . . .

June, 1953



.020 THICK BLADES GROUND 440 AT A TIME ON MATTISON GRINDER FOR SUNBEAM CORPORATION

Here is an unusual grinding job at the Sunbeam Corporation Plant being performed rapidly and accurately with the Mattison Grinder shown above. 440 Shavemaster blades only .020" thick are ground at one time at a considerable saving in time over previous method.

With the Mattison High-Powered Precision Surface Grinder you have the high power and rugged, double-column construction for rapid stock removal; large capacity which means more pieces of work per load; and the precision and sensitivity necessary for fine, high-quality finish and accuracy to close limits.

This combination not only enables you to step up production on small parts but permits grinding large work which previously could not be handled. Send for free circular containing complete information as well as numerous other examples of work ground on the Mattison Grinder.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

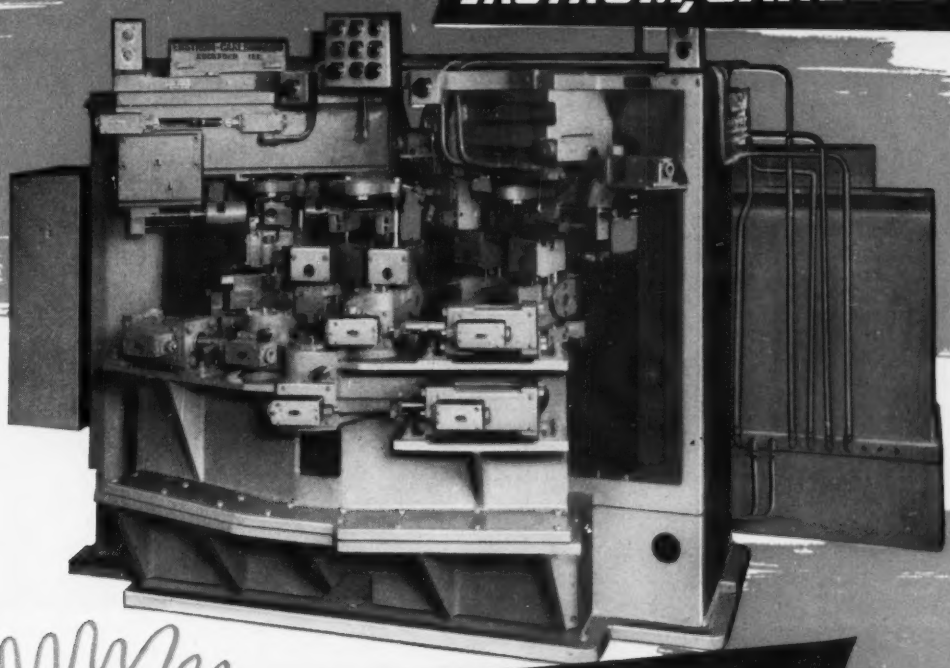
MADE IN

ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP

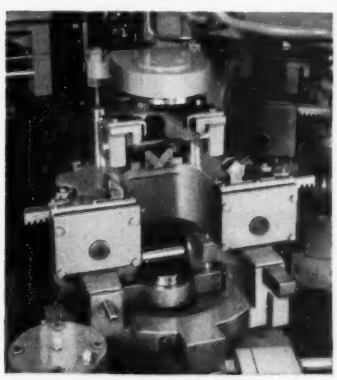
ILLINOIS, U.S.A.

Machinery, June, 1953

EKSTROM, CARLSON

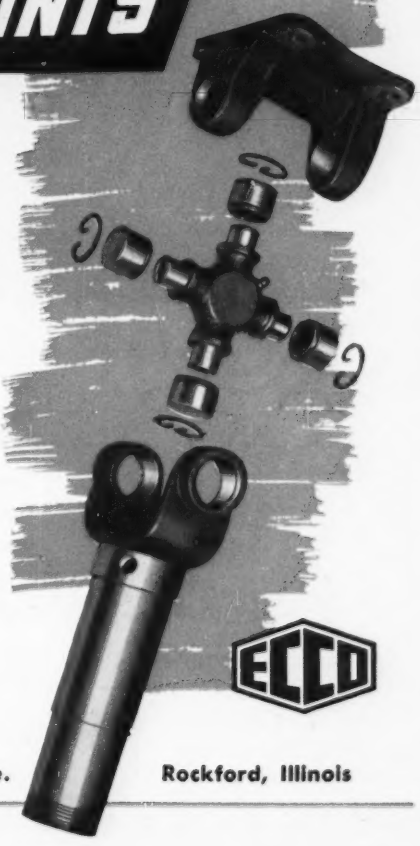


ASSEMBLES UNIVERSAL JOINTS



Above, a close-up of one of the fixtures, showing vee-blocks and plates which close on suitable locations to position and hold all the pieces accurately with respect to each other.

Here is another Ekstrom, Carlson *original**— a 6-station machine that *automatically* completes the assembly of 11 parts that comprise a universal joint: two yokes, the cross, four needle bearings, and four snap rings. The two yokes and the cross are placed into the open fixture, which closes and automatically positions the three pieces with opposed vee-blocks. At the second station two needle bearings are pressed in, at the third station two snap rings; at station four the fixture is rotated 90°, and the needle bearings and snap rings for the other two arms are pressed in at stations five and six to complete the assembly. After loading the fixture, the entire cycle is automatic. Thus Ekstrom, Carlson again shows its ability to solve a troublesome manufacturing problem — let us help you to do *your* job BETTER, FASTER, and MORE ECONOMICALLY!



*Pat. applied for

EKSTROM, CARLSON & CO., Dept. M-4, 1400 Railroad Ave. Rockford, Illinois

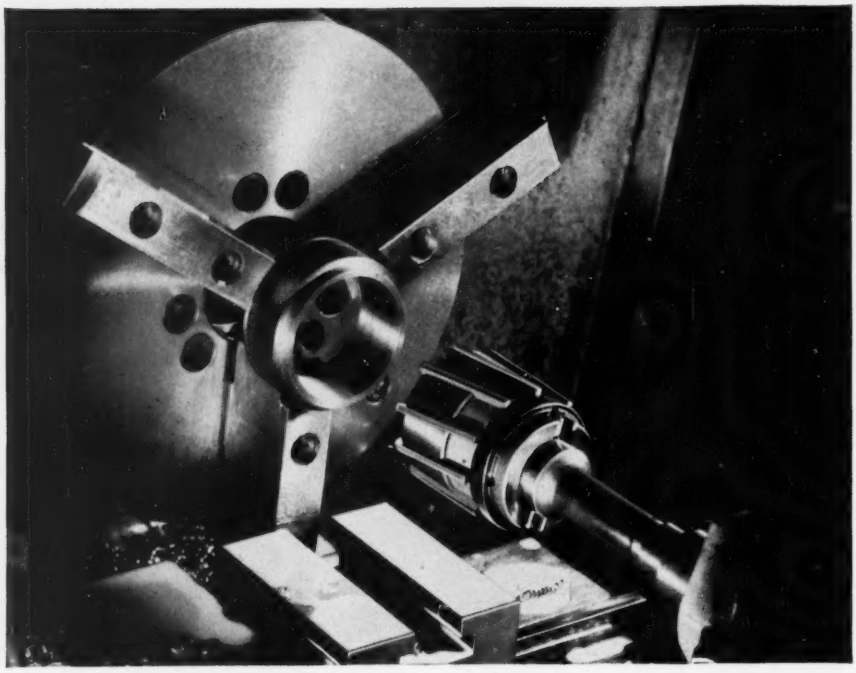
Manufacturers of Machinery and Tools Since 1904

MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD

ILLINOIS, U.S.A.

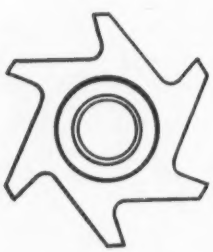
Machinery, June, 1953



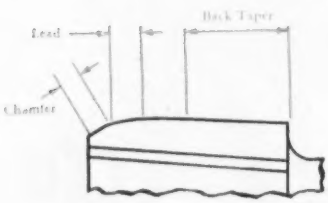
REAMER DESIGN Controls

Accuracy, Finish and Production

Barber-Colman Reamers produce finishes which were not previously considered possible on a standard production operation. Exceptional accuracy and tool life are also obtained on production runs as a result of the special features of Barber-Colman Reamers. Both solid-fluted and inserted-blade reamers are available.



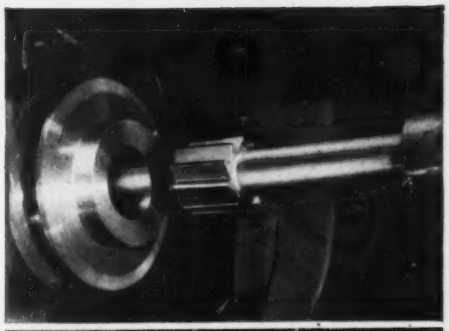
Irregular flute spacing provides a smooth cutting action and fine finish, and helps to prevent the reamer from forming "welts". As a standard feature on all Barber-Colman Reamers, flutes or blades are spaced diametrically opposite each other so that they are easily checked with a micrometer.

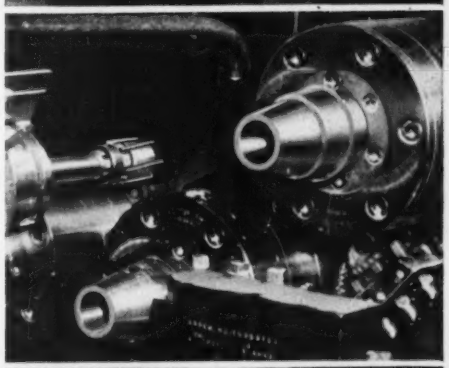


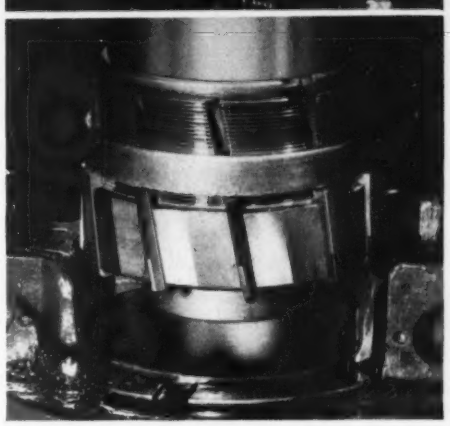
The profile form on Barber-Colman Reamers is designed to produce the best possible finish and tool life. Following the chamfer, the lead is blended into a radius to produce exceptionally fine finishes. Through Barber-Colman cam-controlled sharpening, a sharp cutting edge, rather than a cylindrical land, is produced, resulting in a freer cutting action. With this control, successive reamers are sharpened with exactly the same profile form and relief angles to provide exact duplication of size, straightness and roundness.

DESIGNERS OF STANDARD AND SPECIAL

MADE IN
ROCKFORD...FOR ACCURATE, FAST METAL REMOVAL
ILLINOIS, U.S.A.







20-25 micro-inch finish typical

On this job, 1000 pieces are reamed to a surface finish of 20-25 micro-inches before it is necessary to re-sharpen the reamer. The feed is 1.75″ per minute at 280 rpm., requiring 30 seconds to ream the 7/8″ length of cut. Material is AISI C1137 steel.

1500 pieces per sharpening

This carbide-tipped inserted-blade reamer produces from 1100 to 1500 pieces per sharpening while maintaining the finish better than 60 rms. Tolerance on hole size is .002″. Stock removal is .012″ to .015″ on the diameter, and the material is B1117 steel. Speed is 105 sfm, and the feed is .0088″ per revolution. A Barber-Colman Reamer Sharpener reproduces the correct profile on the reamer blades with each sharpening.

tool cost reduced from $1.57 to $1.32

These Barber-Colman Reamers are producing truck cylinder liners with accurate straight round holes free from welts or taper at a tool cost 15% less than previous records. Material is cast iron. Replaceable blades with carbide tips give long reamer life and cutting edges which stand up under continuous production. 675 more pieces per set of blades are now obtained, and tool cost per 100 liners has been reduced from $1.57 to $1.32.

If you are now choosing between accurate, quality-finish reamed holes — and low-cost production and tool maintenance — you can have both, using Barber-Colman Reamers. More flutes per cutting diameter, solidly backed cutting edges, and standard irregular flute spacing will give you tool room reaming quality under regular production conditions.

Send specifications on hole sizing and finishing problems to Barber-Colman engineers. They will furnish reamers for your particular requirements to give you the desired quality consistently.

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

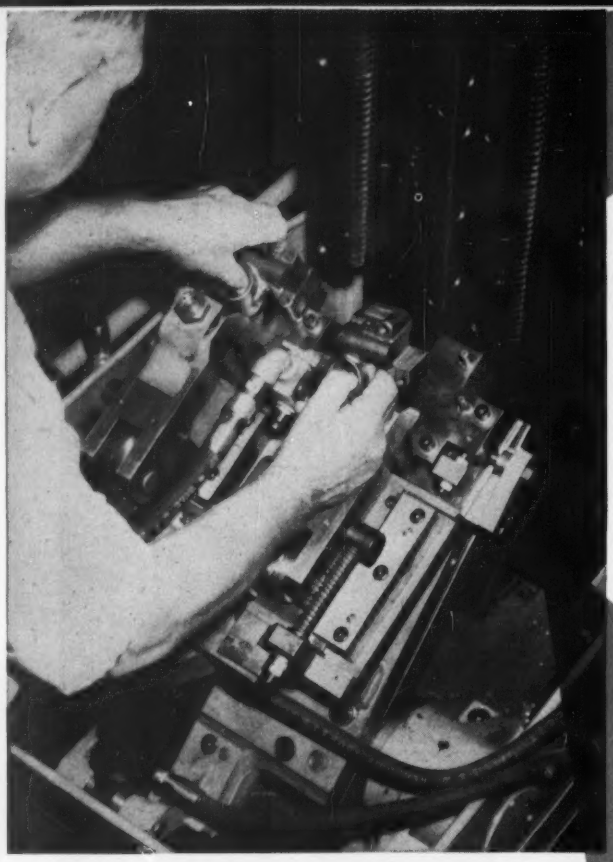
BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 926 ROCK STREET, ROCKFORD, ILLINOIS

METAL CUTTING TOOLS SINCE 1908

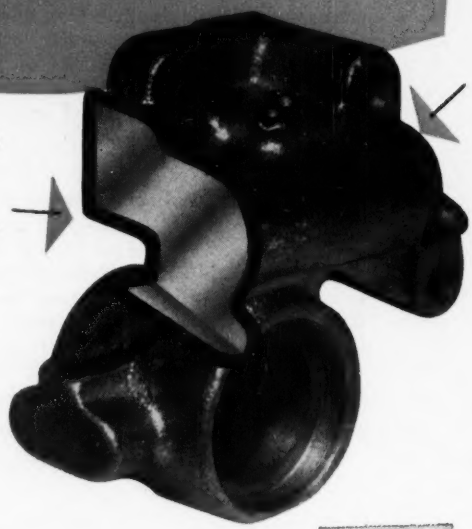
MADE IN
YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN...ROCKFORD
ILLINOIS, U.S.A.



FIXTURE AUTOMATICALLY TILTS, CLAMPS PARTS for GENERATING TYPE BROACHING

Illustrated are the two parallel surfaces broached in one pass on the American SB-42-10 single ram surface broaching machine equipped with a completely automatic fixture.

Speeds production of parking brake brackets designed and built the ***American*** *way*



Two parallel surfaces on each of two parts are straddle broached in one pass on this American SB-42-10 single ram broaching machine. Over 350 of these intricate parking brake brackets are completed every hour.

The complete tooling designed the American Way features:

1. **Generating type broaches.**
2. **Fully automatic work holding fixture with tilting table.**
3. **Automatic clamping and unclamping of parts.**

The operator simply loads and unloads the parts, starting each machine cycle by push button control.

For the answer to your broaching problem send a part-print or sample and hourly requirements to American . . . the organization that gives you the extra advantages of experience in producing all three . . . broaches, machines and fixtures. No obligation. Address Dept. M.

For more information on the American SB-42-10 and other American machines, write for Circular #300.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

American Building - Ann Arbor, Michigan

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

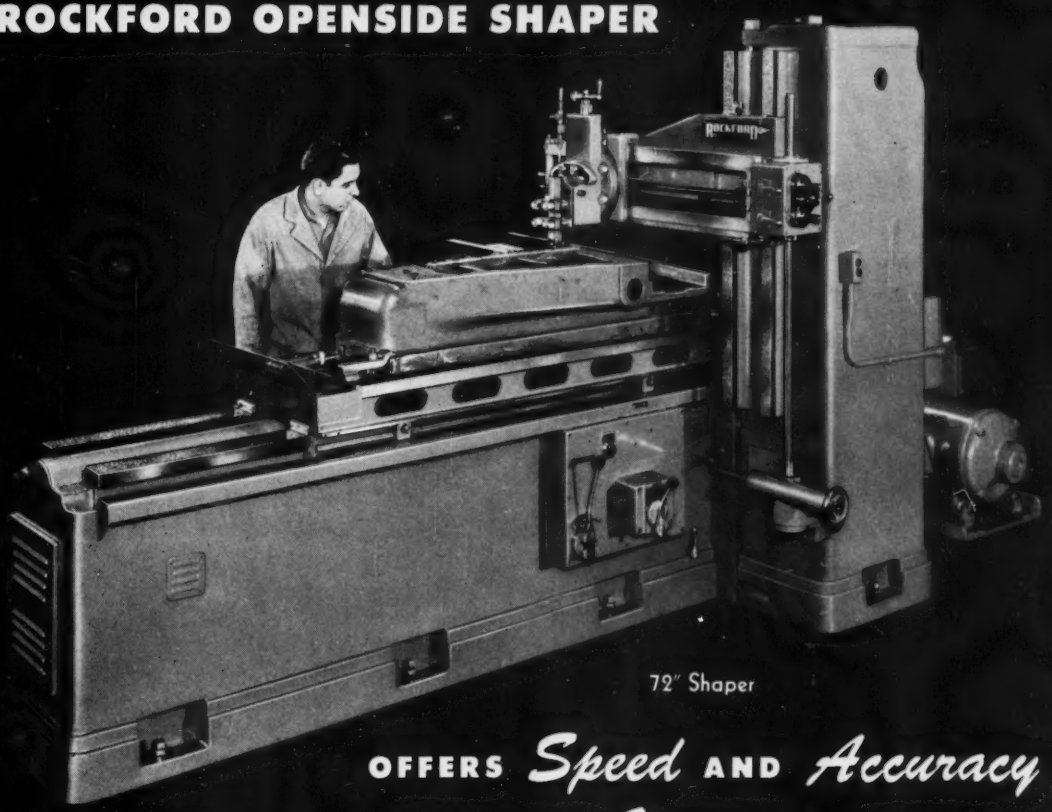
MADE IN

ROCKFORD...MACHINE TOOL SHOPPING CENTER

ILLINOIS, U.S.A.

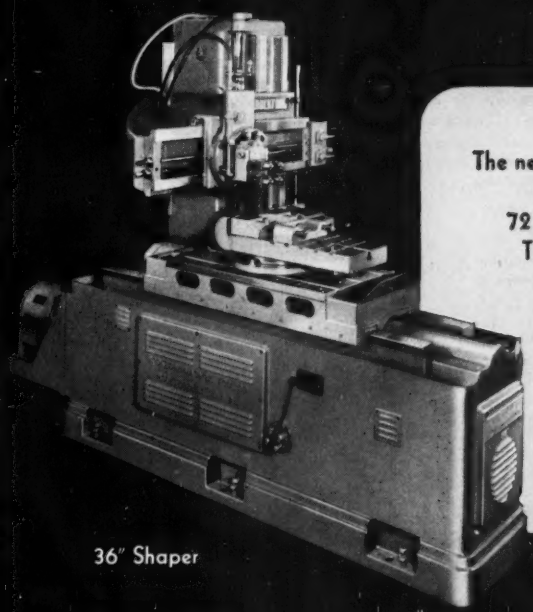
NEW.....

ROCKFORD OPENSIDE SHAPER



72" Shaper

OFFERS *Speed* AND *Accuracy* PLUS *Versatility*



36" Shaper

The new 72" Rockford Openside Shaper gives you best results on *all* shaper jobs — with stroke lengths up to 72 inches.

This "big brother" of the Rockford Openside Shaper family (36", 48", 60", 72") has all the superior features of companion models, *plus* increased capacity. It's the maximum in versatility — large-job capacity with no sacrifice in speed or accuracy. And It's *Hydraulic* . . . of course.

Before you invest, investigate the new 72" Rockford Openside.

Hy-Draulic

ROCKFORD MACHINE TOOL CO.
2500 Kishwaukee Street • Rockford, Illinois

MADE IN
ROCKFORD MADE MEANS PRECISION MADE...ROCKFORD
ILLINOIS, U.S.A.

Machinery, June, 1953

FOR LARGE OR SMALL MACHINES... YOU'LL FIND *DEPENDABLE*

FACILITIES FOR BUILDING "SPECIALS"

Designing a special machine tool is one task. Building the unit to meet production demands and to run day-in and day-out without costly shut-downs, is quite another matter — a good deal depends upon the proper facilities. The best of modern equipment and precision tools are required. That's why at Barnes, one of the best-equipped plants in the Mid-west, you'll find complete and adequate facilities which make not only for efficient work, but provide the means for building better machines to meet high production goals and reduce costs.

Coordinated 6-Point Service at Barnes Saves Time

The complete machine tool building service at Barnes, you'll find, will help you solve problems quickly and efficiently. You get a complete machine all from one source because work is coordinated in one plant:

1 **SPECIALIZED MANUFACTURING FACILITIES** — 80 year background, large well equipped plant efficiently tooled to produce high production machines.

2 **SPECIAL HYDRAULIC EQUIPMENT** — designed and built to meet JIC standards. Individually engineered units assure smooth, dependable actuation for every requirement.

3 **SPECIAL GAUGES, FIXTURES, TOOLS** — designed for each individual machining problem, assure accuracy of operation at high production speeds.

4 **SPECIAL ELECTRICAL EQUIPMENT and CONTROLS** — individually designed and built for maximum safety and ease of control with circuits that assure the most dependable coordination of all machine functions.

5 **SPECIAL HANDLING AND CONVEYOR EQUIPMENT** — designed and built to reduce work handling, effect maximum safety and efficiency.

6 **COORDINATED DESIGN AND ENGINEERING** — Mechanical, Hydraulic, Electrical, Process, Tool, and Fixture Engineers work together at Barnes. Team-work solves complex problems quickly.

W. F. & JOHN BARNES

Builders of Better Machines Since 1879

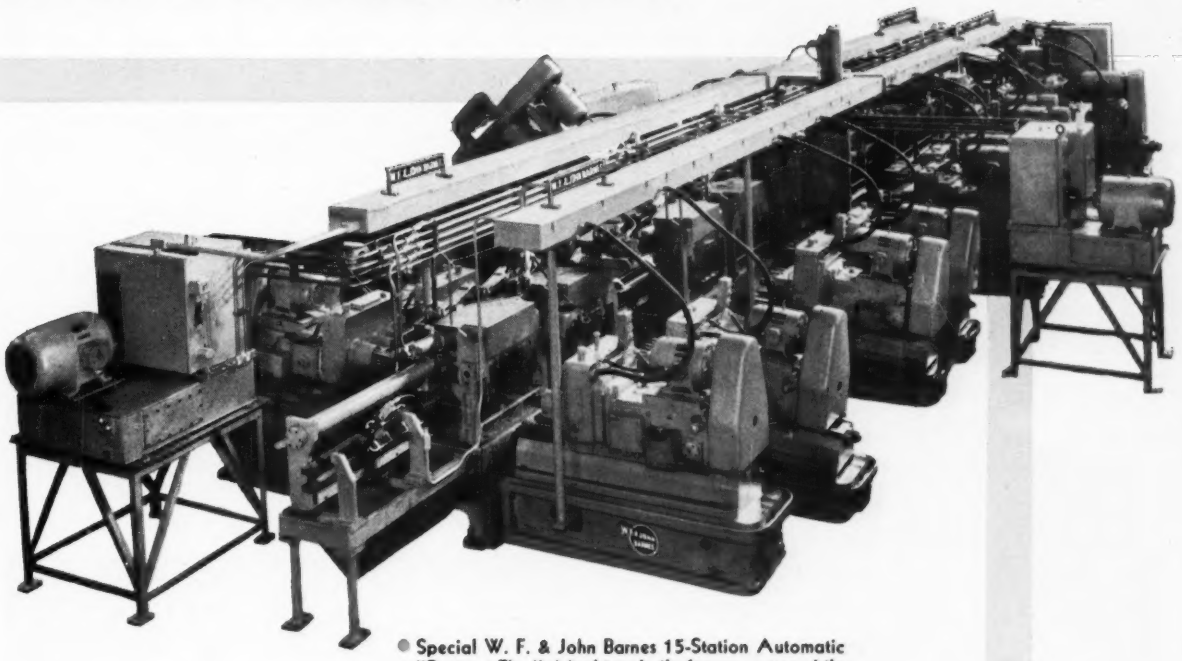
MULTIPLE SPINDLE DRILLING • BORING • TAPPING MACHINES

MADE IN

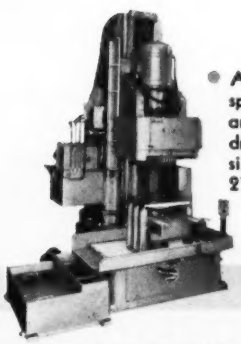
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS

ILLINOIS, U.S.A.

. AT W. F. & JOHN BARNES



● Special W. F. & John Barnes 15-Station Automatic "Progress-Thru" Machine built for an automobile manufacturer for machining cylinder heads. A total of 78 machining operations are handled automatically at a gross production rate of 117 pieces per hour. The entire unit, including hydraulic and electrical circuits, designed for easy accessibility.



● A typical small multiple spindle machine designed and built by Barnes — drills 40 — .332" holes simultaneously. Produces 27 pieces per hour.

Write for Free Data

● Ask for free booklet "Coordinated Machine Engineering" describing the scope of Barnes machine tool building service. Illustrates and describes modern machines and mass production techniques.

W. F. & JOHN BARNES COMPANY • 310 S. WATER STREET, ROCKFORD, ILLINOIS

AUTOMATIC PROGRESS-THRU AND TRANSFER TYPE MACHINES

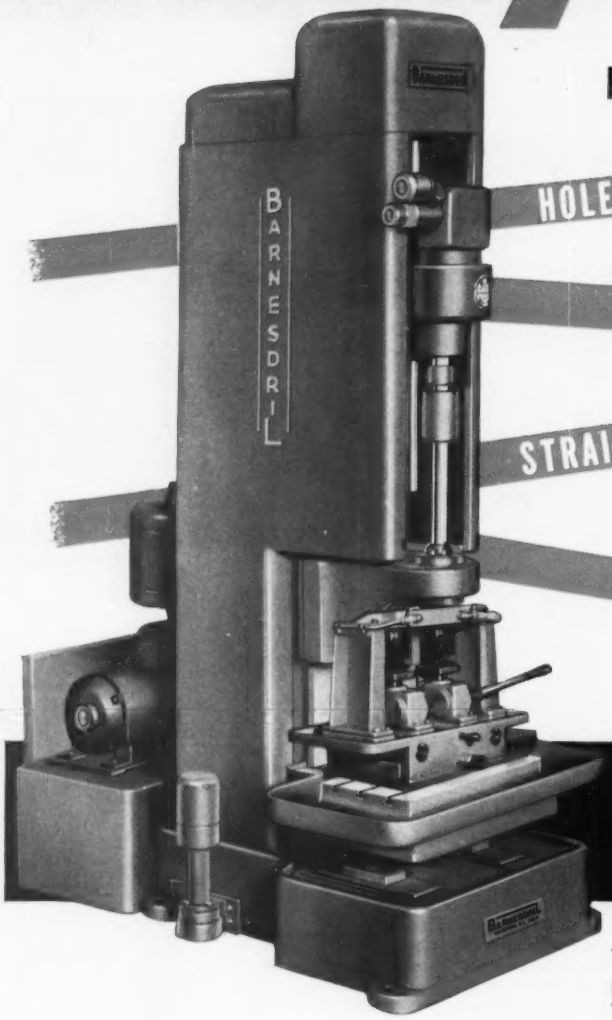
MADE IN

CENTER OF MACHINE TOOL EXCELLENCE...ROCKFORD

ILLINOIS, U.S.A.

automatic Production

FOR



HOLE SIZING

FINISHING

STRAIGHTNESS

ROUNDNESS

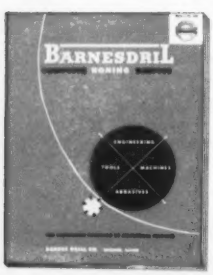
with NEW No. 305 Production Honing Machine

This new automatic machine now takes full responsibility for precision hole sizing, finishing, straightness and roundness. You can be sure of precision bore-to-bore sizing because the machine — latest in a complete line of **BARNESDRIL** Honing Process Equipment — removes the sizing operation from the effects of cut-and-try methods, uneven stone wear, and variations in finish from bore-to-bore.

The machine has a range of 2" to 5½", 25" stroke, and finishes bores up to 22" length. It provides truly high production hole finishing for a variety of small and medium parts with a minimum of production controls.

You are invited to view the New No. 305 Honing Machine and see the many production features it offers for fast, high quality, low cost bore finishing.

Send Parts Drawings for Estimate



Get a Copy of this new Complete Honing Service Bulletin No. 5005

HOLE **BARNESDRIL** FINISHING

BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

MADE IN

ROCKFORD...CITY OF MACHINE TOOL SPECIALISTS

ILLINOIS, U.S.A.

INGERSOLL

BLADES: $117.30
CHIPS: 27 TONS

Equipped with 34 carbide-tipped blades costing only $117.30, this 24" diameter Ingersoll Shear Clear Face Mill removes 27 tons of hard die block steel before the blades are used up in resharpening.

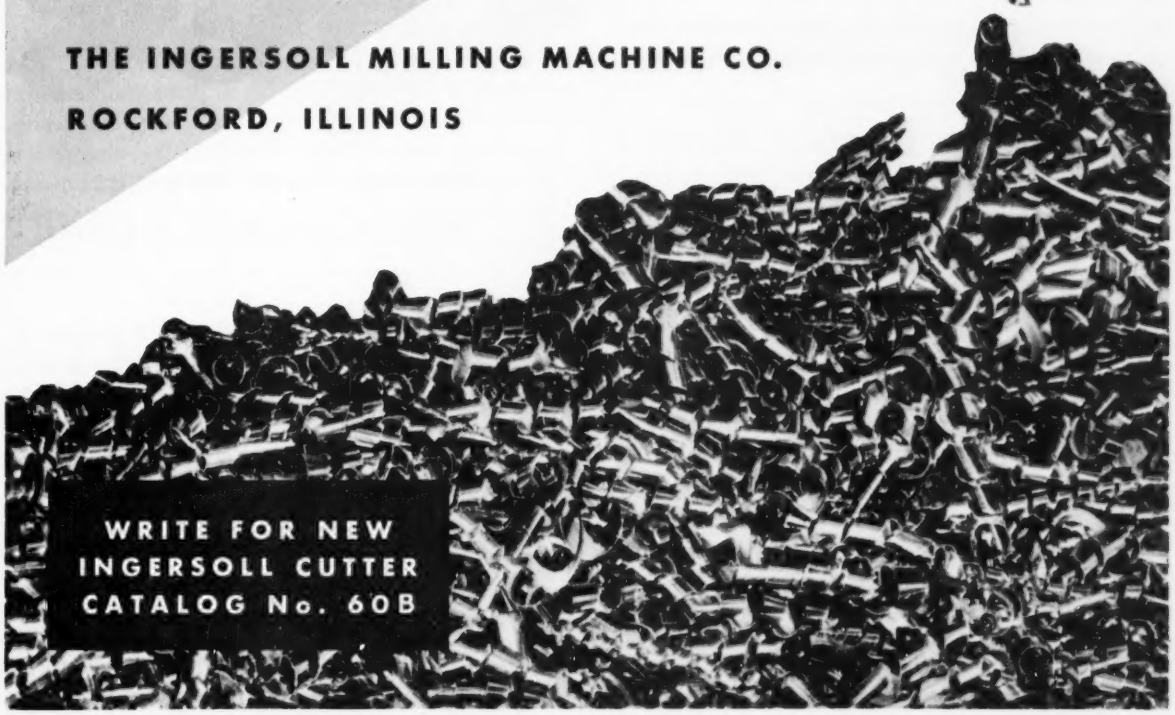
Blades for Ingersoll cutters are of the highest quality, yet they are the most economical for you to buy because they are manufactured with good production equipment.

The *low cost of replacement blades* is another reason why you should use

INGERSOLL INSERTED BLADE MILLING AND BORING TOOLS

THE INGERSOLL MILLING MACHINE CO.

ROCKFORD, ILLINOIS



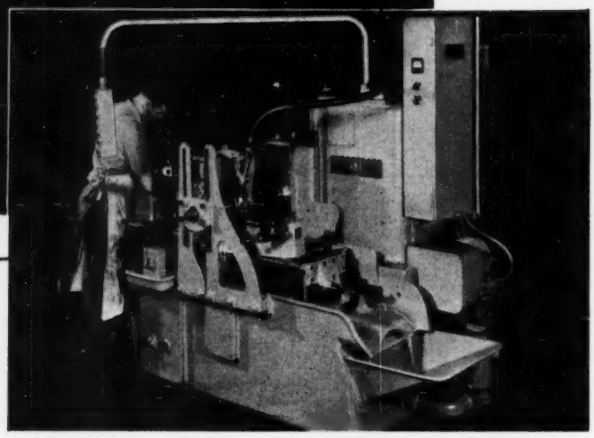
WRITE FOR NEW INGERSOLL CUTTER CATALOG No. 60B

MADE IN

YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN... **ROCKFORD**

ILLINOIS, U.S.A.

How To Use SUNDSTRAND "Engineered Production" Service To Get Practical Milling Methods



Basically, there are two approaches to solving milling production problems, (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machinery, if necessary.

The latter method is Sundstrand "Engineered Production" Service . . . the most practical approach to economical milling. The following is a brief resume of the complete engineering and manufacturing service available from Sundstrand to meet any of your production milling requirements.

These actual examples are presented to reveal one of each of the methods used in solving milling production problems. One of these methods may be the solution to your present problem.

1 Milling Steel Forgings With a Standard Rigidmil

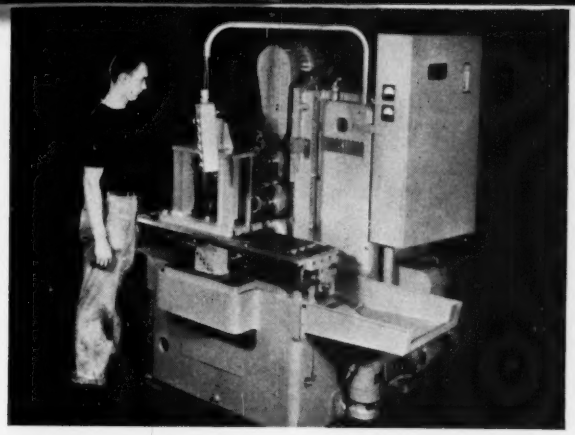
This Standard Sundstrand Model 33 Rigidmil is equipped with a special manually operated left and right hand fixture. Operator loads the rough forgings into the left hand fixture where a 1.875″ slot and one face is milled. The workpiece is then removed from the left hand fixture and loaded into the right hand fixture for milling a 1.640″ groove. Production for both operations totals 32 pieces per hour.

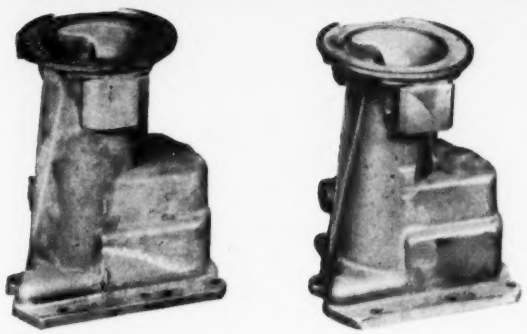
SUNDSTRAND

RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

MADE IN ROCKFORD...FOR MACHINES DESIGNED TO SUIT YOUR PRODUCTION

ILLINOIS, U.S.A.





2 Standard Rigidmil With Special Head Mills 2 Surfaces Simultaneously

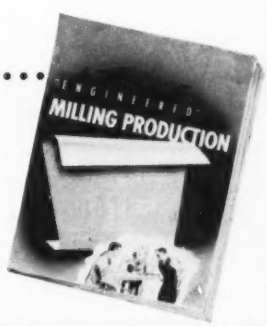
Here's a good example of a standard machine tooled to do special production milling. This standard Sundstrand Model 22 Rigidmil has been provided with a special two-spindle head with independent drive to each spindle. The machine simultaneously mills the bottom face and the flange on a transmission bearing retainer held in simple fixture. In an automatic cycle of rapid approach, feed and rapid return, 60 pieces are milled each hour.

3 Special Rigidmil Mills Contours and Root Radius of Turbine Bucket Blades

Here is a Sundstrand Special 3 Station Contour Milling Machine. Three separate milling units are mounted on one main base for milling the contour of turbine blades. Unit No. 1 mills the inside contour of the part. Unit No. 2 mills the outside contour and unit No. 3 mills the root radius. Machine cycle is automatic and operator has only to transfer the piece from one station to the next. Production is 25 blades per hour.

Free Data

Write for more proof of successful applications of Sundstrand "Engineered Production" Service. This 40 page book contains over 35 actual problem solutions together with interesting tooling diagrams. Write for your copy today. Ask for Bulletin No. 632.



SUNDSTRAND

SUNDSTRAND
Machine Tool Company
2530 Eleventh St. Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

MADE IN
FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD
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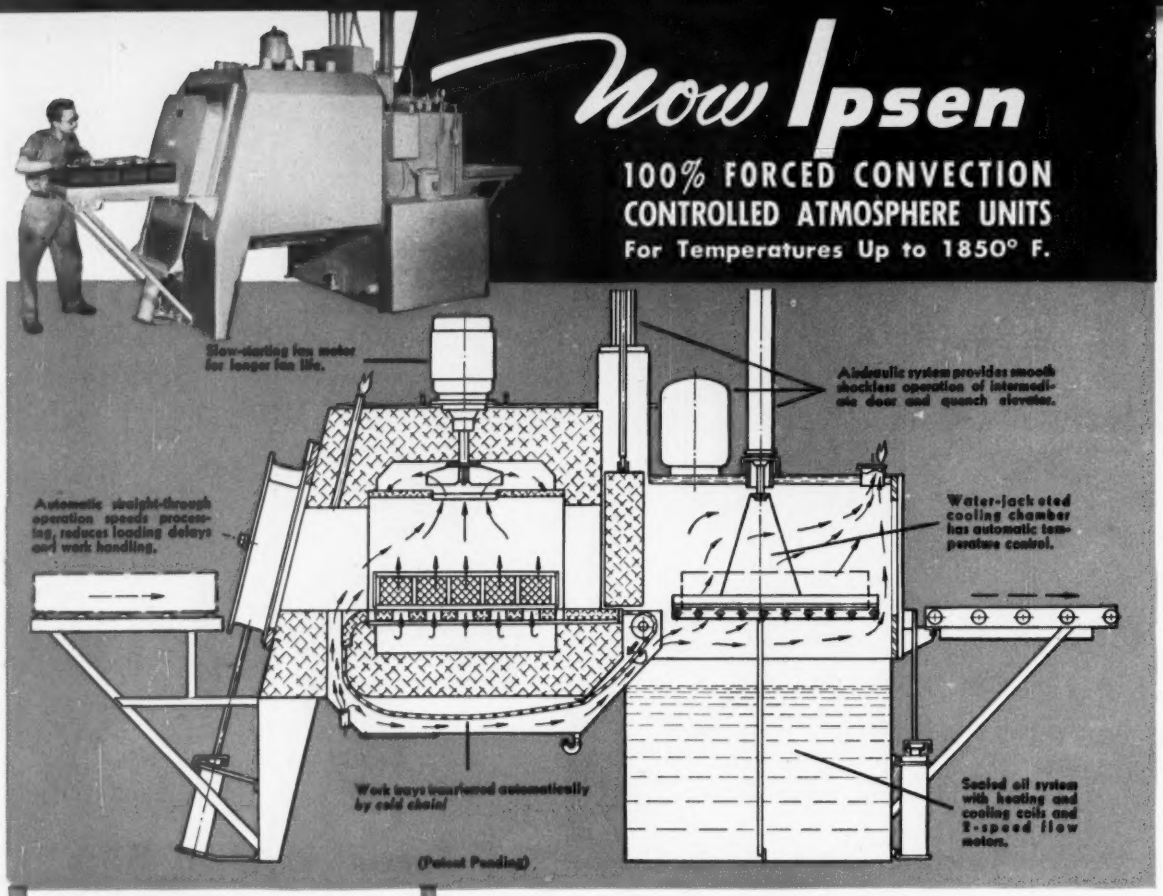
Now Ipsen

100% FORCED CONVECTION CONTROLLED ATMOSPHERE UNITS

For Temperatures Up to 1850° F.


Slow-starting fan motor for longer fan life.
Hydraulic system provides smooth shockless operation of intermediate door and quench elevator.
Automatic straight-through operation speeds processing, reduces loading delays and work handling.
Water-jacketed cooling chamber has automatic temperature control.
Work trays transferred automatically by cold chain!
Sealed oil system with heating and cooling coils and 2-speed flow motor.
(Patent Pending)

1 Heat and quench signal lights
2 Automatic temperature recorder
3 Heating cycle timer
4 Quench timer
5 Hi oil flow timer
6 Selector switch for air or oil
7 Cycle start button

SIMPLE CHANGE-OVERS

Change-over from one process to another is simple, quick, and easy. Settings for heat, atmospheres, quench and oil flow is all that is required. Cycle is then controlled automatically.

★Above is a cross-section view of the Ipsen 400 Lb./Hr. Furnace showing the advanced design features which have made Ipsen the largest manufacturer of carbonitriding and batch-type heat treating units. With these new units, you get the advantages of 100% forced convection heating and controlled atmosphere processing, *plus* the full benefits of automatic straight-through operation. Thus, you eliminate loading delays and guess-work. You control distortion and get uniform results from batch to batch . . . today, tomorrow, or next year. You eliminate blasting and pickling operations and you can often use lower grade, less costly steels.

A SINGLE UNIT HANDLES ALL OF THESE OPERATIONS

Unusually versatile, the Ipsen is built for temperatures up to 1850° F., and a single unit is equipped to handle all of the following processes:

ATMOSPHERE COOLING	OIL QUENCHING
Normalizing	General Hardening
Stress Relieving	Carburizing and Hardening
Carburizing	Carbonitriding
Carbonitriding	Martempering

Send **Samples for Free Estimate** — find out how the new Ipsen Units can be applied to your job. Samples of your work will be run, procedures established in our new, modern lab, and cost estimates given without obligation.

Write **for New Literature** — illustrates new design features, gives complete specifications of various units.

AUTOMATIC **Ipsen** HEAT TREATING UNITS

IPSEN INDUSTRIES, INC. 717 South Main Street; Rockford, Illinois

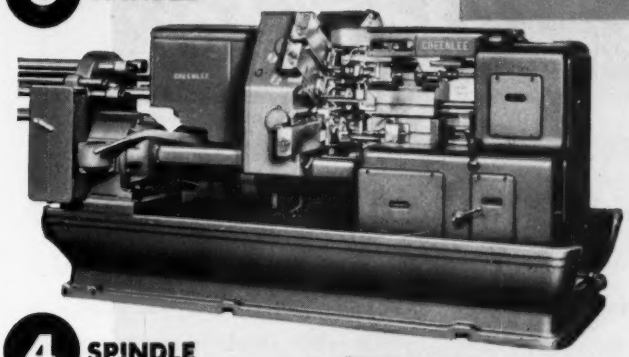
Universal Units to CARBONITRIDE • CARBURIZE • HARDEN • BRAZE • MARTEMPER • WASH • TEMPER

MADE IN ROCKFORD...MACHINE TOOL PLANTS CLOSE TO YOUR PLANT

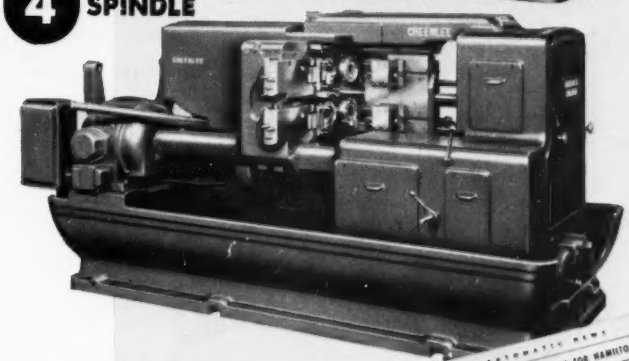
ILLINOIS, U.S.A.

GREENLEE AUTOMATICS

6 SPINDLE



4 SPINDLE



Maximum economy of operation on long-run jobs, with an uncluttered, easily-reached tooling area that allows rapid and accurate positioning of tools and attachments . . . permitting precise inspection of work finish and tolerances *on the machine.* The Greenlee "Six" is available in 1″, 1-5/8″, and 2″ capacity — the "Four" in 1-5/8″ and 2-5/8″ capacity.

PRODUCTION MACHINERY

GREENLEE

Automatic News

These free monthly issues are written expressly for those of you who are concerned with various phases of automatic screw machine production. They contain practical and informative articles dealing with tooling and maintenance, generously illustrated with drawings and photographs. If you wish your name added to our mailing list, send your request, on company letterhead, to:

The Editor, *Automatic News*

GREENLEE BROS. & CO.
1866 Mason Ave., Rockford, Illinois

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

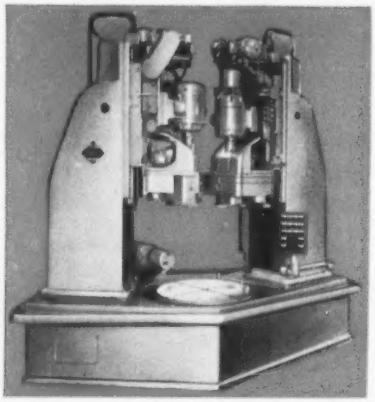
MADE IN

FOR METAL REMOVAL WITH ACCURACY AND SPEED...**ROCKFORD**

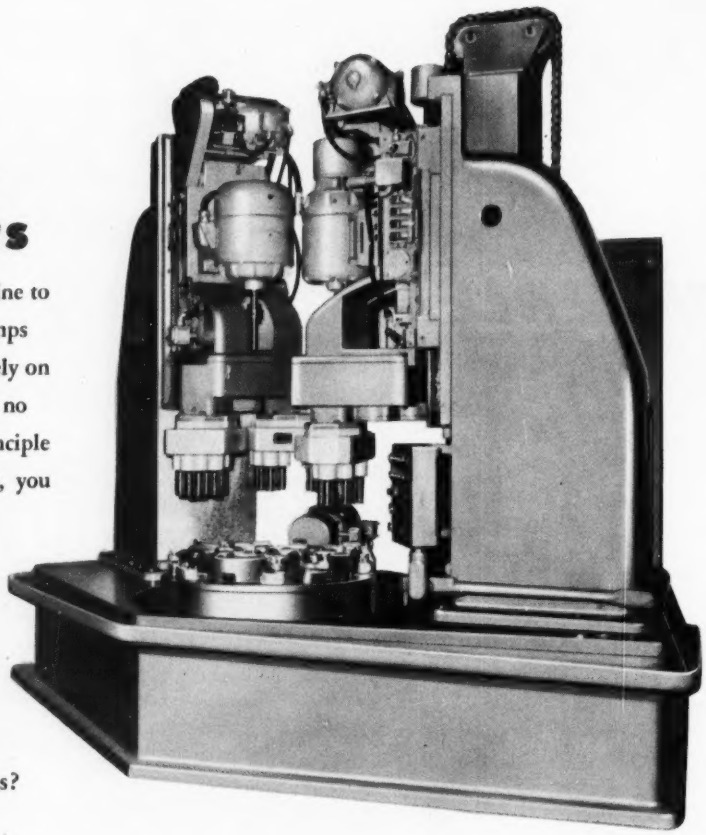
ILLINOIS, U. S. A.

Rehnberg-Jacobson

BENDIX PACIFIC DIVISION PUT THEIR OWN HEADS AND FIXTURES ON THIS "BARE" MACHINE



Each set of four fixtures is mounted on a common base plate, which is located on the Index Unit by crossed T-slots and dowel pins. The multiple-spindle heads are easily removed and replaced by other spindle patterns. The picture at the left shows the "bare" machine as it was shipped, the picture below shows one set of heads and fixtures in place.



USED ON PUMP AND VALVE PARTS

The Bendix Pacific Division uses this machine to process a variety of parts that go into pumps and valves for hydraulic lifts used extensively on agricultural implements. There is almost no limit to the variety of ways in which the principle of this machine — we build the machine, you furnish the heads and fixtures — can be adapted to different purposes. One feature, in this case, is the right-hand unit — which can be changed from a drilling unit to a tapping unit simply by throwing a single lever. Can we develop something like this to solve *your* present or future production problems?

REHNBERG-JACOBSON MFG. COMPANY

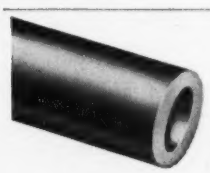
DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST.
ROCKFORD, ILLINOIS

MADE IN
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.

you're missing something if you fail to remember

CRUCIBLE HOLLOW TOOL STEEL



Manufacturers of ring-shaped tool steel parts who don't use Crucible Hollow Tool Steel in their operations are missing a good bet. Already, some users have cut just their material costs as much as 20% by using it in place of regular bar stock.

This hollow form of Crucible tool steel is available in three famous grades: KETOS, AIRDI 150 and SANDERSON. And it is supplied with machine finished inside and outside diameters and faces — cut to your specific length requirements.

With Crucible Hollow Tool Steel, toolmakers can now eliminate drilling, boring, cutting-off and rough facing operations. This, of course, reduces production time, increases machine capacity and cuts scrap losses.

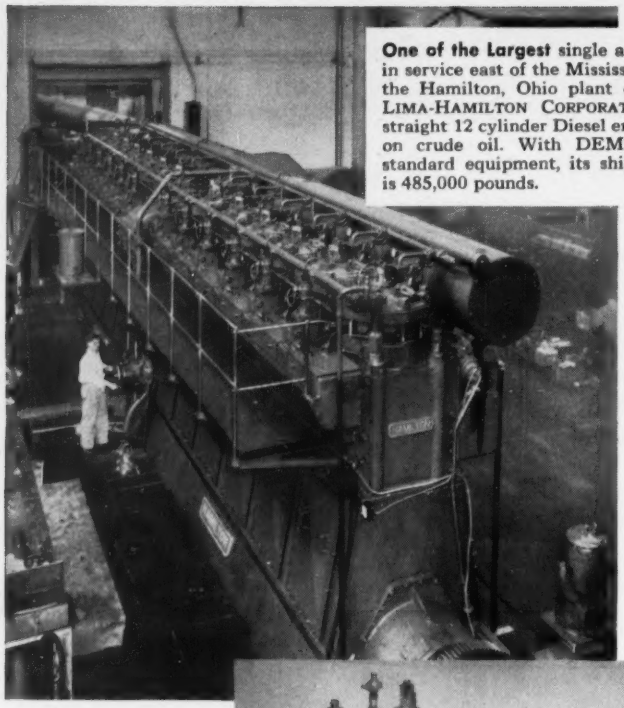
For further information, call your nearest Crucible warehouse . . . or write for new brochure describing Crucible Hollow Tool Steel, Dept. M, Crucible Steel Company of America, Chrysler Bldg., New York 17, N. Y.

CRUCIBLE first name in special purpose steels

53 *years of* Fine *steelmaking*

HOLLOW TOOL STEEL

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.



One of the Largest single acting engines in service east of the Mississippi. Built at the Hamilton, Ohio plant of BALDWIN-LIMA-HAMILTON CORPORATION, it is a straight 12 cylinder Diesel engine running on crude oil. With DEMA stationary standard equipment, its shipping weight is 485,000 pounds.

Nickel Alloys Help build stamina into an Engine that serves a city

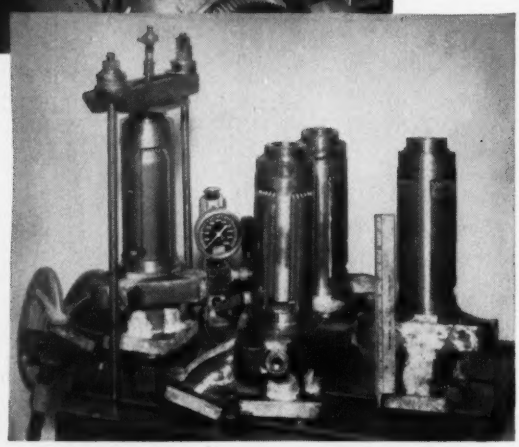
Built to handle the main power load for the city of Decatur, Indiana, this unit shows how nickel alloyed steels and irons are used in advanced design for increased power, quieter operation and longer trouble-free life.

Its forged crankshaft gear ... specified in Type 4340 or 9845 nickel alloyed steel ... provides:

Tensile strength	140,000 psi minimum
Yield Strength	118,000 psi
Elongation	16%
Reduction in area	45%
Brinell hardness	280 to 310

Piston heads are cast in high strength nickel-chromium iron to withstand heat stresses. Cylinder liners are one-piece castings containing .50% to .75% nickel and .25% molybdenum, for resistance to both heat and wear. Carburized nickel-molybdenum steel, Type 4615, is ordinarily specified for cams and rollers, and wrist pins are of Type 8620 nickel-chromium-molybdenum steel.

Consult us on the advantages of nickel in your products or equipment. Send us details of your applications for our suggestions.



Ductile Iron Gas Valve Bodies for HAMILTON Diesel engines undergo an 800-pound pressure test prior to assembly. Steel jackets are welded to these bodies with Ni-Rod 55. The castings are stress relieved for four hours, at 1200°F., and placed in service at 240 BHN. The Ductile Iron bodies prove sounder than those of cast steel, are easier to machine, and combine ample strength and ductility to withstand sudden pressure overloads.

At the present time, nickel is available for end uses in defense and defense supporting industries. The remainder of the supply is available for some civilian applications and governmental stockpiling.

EMBLEM OF INCO SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

INTRODUCING BEARCAT TOOL STEEL

Super Shock-Resisting ...Versatile, Too!

Here's a brand-new tool steel that we've been developing over the past several years. Proven in a wide variety of production tools and dies, Bearcat is a general-purpose steel especially suited for uses where shock-resistance, hot-work properties and easy machining are important.

Some of Bearcat's big features:

- Super shock-resistance
- Deep-hardening . . . in air
- Easy to machine (Brinell 197 max)
- Low distortion in heat-treatment
- Good hot-work properties
- Easily carburized for long wear

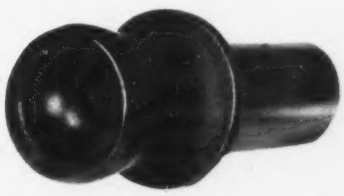
These are not just claims made for a new, untried steel! Bearcat has been thoroughly tested in applications such as rivet sets, hot gripper dies, punches, chisels, moil points, forming dies. All of the possible uses for Bearcat have not yet been explored, but we expect it to be ideal for hot headers, blanking dies, master hobs, machined-cavity molds, and many general-purpose tools and dies.

Bearcat is stocked in our mill depot and it's also available through your local Bethlehem tool steel distributor.

Typical analysis:

C	Mn	Si	Cr	Mo
.50	.70	.27	3.25	1.40

Complete data may be had by writing us for Booklet 341. Address your request to Room 1037, Publications Dept., Bethlehem Steel Co., Bethlehem, Pa.



BEARCAT DRIVES 27 TIMES MORE HOT RIVETS

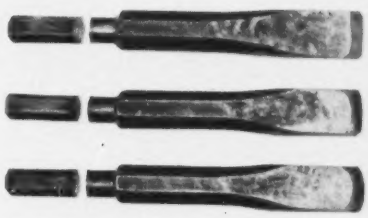
Here's one example of what Bearcat can do on a job that calls for both shock-resistance and good hot-work properties. This typical rivet set, made from Bearcat, drove 43,094 rivets and was still in good condition. Rivet sets made from carbon tool steel, and used under similar conditions, drove an average of only 1566 rivets before recupping was required.

THE BETHLEHEM TOOL STEEL ENGINEER SAYS:
High-Carbon Tool Steels Can Be Carburized

Many people don't realize that carburizing can be accomplished with the high-carbon, high-chromium steels—such as our Lehigh H, which contains 1.55 pct carbon and 11.50 pct chromium. The carburizing of tools made from such steels can be either helpful or harmful, depending upon whether the carburized case is produced intentionally or accidentally.

Tools intended for light loads and long service, such as lamination dies, are often intentionally carburized before quenching. Such dies have greatly improved resistance to wear because of the carbon added to the wearing surfaces. The usual procedure is to use carburizing compound as a packing medium and heat for the normal length of time at the quenching temperature.

Sometimes an accidental carburized case results when "spent" carburizer is used as a protective packing medium when heating for hardening. Spent carburizer is often almost as active as new carburizer. An accidentally produced carburized case is not always harmful. It may even be helpful. But there are many heavy-duty tools and dies that will develop chipped or spalled edges if they become carburized. When treating tools of this type, use cast-iron chips as a packing medium during hardening.



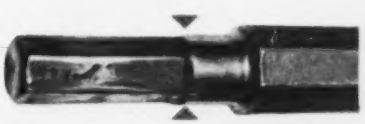
All of the chisels broke in service at the sharp change of section. While this is classed as a mechanical error, it does show how improper design can cause failure no matter how carefully a tool may be heat-treated.

Chisel Breakage Cured by Undercutting Shanks

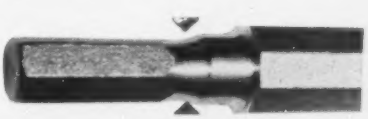
A large user of chisels—made from a top-grade shock-resisting steel, Bethlehem Omega—reported excessive breakage. One of our metallurgical sleuths soon put his finger on the trouble.

When the hexagon shanks were milled by the customer, a milling cutter was used which did not have an adequate radius. As a result, stresses were concentrated at the sharp change of section in the shank. Subjected to heavy impacts in air hammers, the chisels broke prematurely—and always at this portion of the shank.

The solution for the breakage was one that really surprised the customer. See photographs below.



This shank shows the "stress raiser," caused by the lack of sufficient radius, where the milled hexagon section meets the round section.



All of the unused chisels were salvaged by having an undercut ground on the shanks so that a ½-in. radius was provided at the source of the trouble. Despite the smaller section, these chisels gave good service. The sharp change in section was eliminated, stresses were better distributed.

CUMBERLAND GROUND BARS

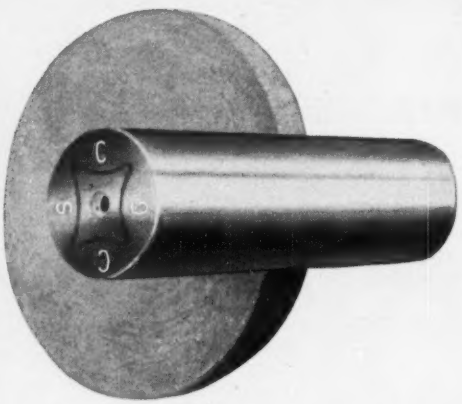
We manufacture 8" diameter, 7-1/2", 7", 6-1/2", 6", and also odd and intermediate sizes down to and including 1-1/8".

ON THE WEST VIRGINIA SHORE, OVERLOOKING THE POTOMAC RIVER, STANDS THE JAMES RUMSEY MONUMENT

The first practical steamboat in the world was run on the Potomac River a few miles below Cumberland, Maryland.

GEORGE WASHINGTON said in his diary, under date of September 6, 1784: "Remained at Bath all day and was shown the Model of a boat constructed by the ingenious Mr. Rumsey, for ascending rapid currents by mechanism; the principles of this were not only shown, and fully explained to me, but to my very great satisfaction, exhibited in practice in private under the injunction of secrecy—."

At a later date GEORGE WASHINGTON said in his diary: "Spent the afternoon with Mr. Rumsey and then Alexander Hamilton and I rode on to Cumberland, Maryland."



Symbol of Quality

Approximately 100 years after the exhibit of this steamboat, Cumberland began grinding bars. They found through experience this was the best method by which accurate steel bars could be produced. These bars are so carefully ground that they are adapted for mass production where gears, pulleys, sprockets and bearings must slide on the bars without delay due to filing or fitting.

IMMEDIATE BARS

DISTRIBUTED BY

Baltimore, Maryland—Addison Clarke & Bro.
Boston, Mass.—Hawkridge Brothers Company
Bridgeport, Conn.—Hunter & Havens, Inc.
Buffalo, N. Y.—Jos. T. Ryerson & Son, Inc.
Cambridge, Mass.—Brown-Wales Company
Charlotte, No. Carolina—Edgcomb Steel Co.
Chicago, Ill.—Central Steel & Wire Co.
Cincinnati, Ohio—Jos. T. Ryerson & Son, Inc.
Cleveland, Ohio—The Bissett Steel Company
Detroit, Michigan—Central Steel & Wire Co.
Fort Worth, Texas—C. A. Fischer
Hartford, Conn.—Hunter & Havens, Inc.
Indianapolis, Ind.—Tanner & Company
Jersey City, N. J.—Jos. T. Ryerson & Son, Inc.
Lakeland, Fla.—Mine & Mill Supply Co.
Los Angeles, Calif.—Link-Belt Co., Pacific Div.
Louisville, Ky.—Neill-LaVielle Supply Co.
Martinsburg, W. Va.—W. H. Heiston & Son
Milwaukee, Wis.—Central Steel & Wire Co.
Montreal, Canada—Drummond, McCall & Co., Ltd.
New Orleans, La.—R. J. Tricon Co.
New York City, N. Y.—Bright Steel Corp.
Oakland, Calif.—Link-Belt Co., Pacific Div.
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Pittsburgh, Pa.—McKee-Oliver, Inc.
Portland, Maine—W. L. Blake & Company
Portland, Oregon—Link-Belt Co., Pacific Div.
Providence, R. I.—Congdon & Carpenter Co.
San Francisco, Calif.—Link-Belt Co., Pacific Div.
Seattle, Wash.—Link-Belt Co., Pacific Div.
Spokane, Wash.—Link-Belt Co., Pacific Div.
Toronto, Canada—Drummond, McCall & Co., Ltd.
Worcester, Mass.—Pratt & Inman

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U. S. A.
ESTABLISHED 1845 **INCORPORATED 1892**

Phosphatizing steel

CRYSCOAT-HC DOES A FINE JOB COATING 90 MM. SHELLS

This munitions maker says that Oakite CrysCoat HC put a heavy phosphate coating on 385,000 shells with "absolutely no trouble . . . maintenance and control are very easy."

Electrocleaning zinc die castings

No. 95 HAS CUT OUR CLEANING REJECTS BY MORE THAN 90%

Estimates a hardware manufacturer who found other "very fine advantages" in the use of Oakite Composition No. 95 for conditioning zinc-base die castings before plating.

Rust prevention

THIS SAVING HAS BEEN OVER $1,000 A MONTH

Reports appliance manufacturer after 6 months use of Oakite Special Protective Oil for protecting precision steel parts from rusting between machining operations.

Solvent cleaning of steel

WE SAVED $394 LAST MONTH . . . NOT ONE REJECT

Reported a manufacturer who used Oakite Composition No. 8 for cleaning hydraulic cylinders and protecting their machined surfaces from rusting before installation.

Burnishing

STEEL GEAR PLATES LOOK LIKE MIRRORS. O.C.#3 IS HERE TO STAY

This maker of aircraft instrument parts said more about our fine burnishing material: "Pinions are polished to the roots of the gears. Magnesium parts are brilliant."

We help our customers write success stories

Every day 200 Oakite Technical Service Representatives use Oakite cleaning materials and Oakite methods to help thousands of Oakite customers accomplish metal-cleaning jobs that are important parts of big production operations.

When a busy customer sends a few words of appreciation—like those quoted on this page—we look on his words as a *success sentence* that we have helped him write in his *success story*. And we feel proud of our co-authorship.

How about your success story? If you will mail the coupon, we'll be glad to tell you how we can help.

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

OAKITE PRODUCTS, INC., 26 Rector St., New York 6, N. Y.

Tell me about Oakite methods for the indicated jobs:

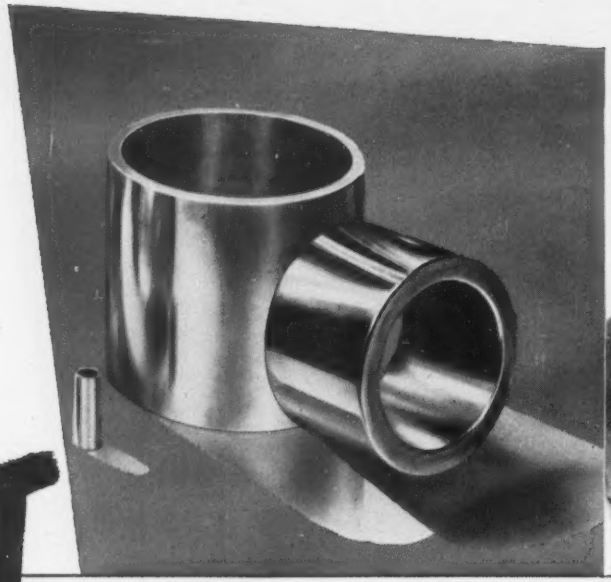
- ☐ Tank cleaning
- ☐ Machine cleaning
- ☐ Electrocleaning steel
- ☐ Electrocleaning non-ferrous materials
- ☐ Pickling, deoxidizing
- ☐ Pre-paint treatment
- ☐ Paint stripping
- ☐ Steam-detergent cleaning
- ☐ Barrel cleaning
- ☐ Burnishing
- ☐ Rust prevention
- ☐ Treating water in paint spray booths

☐ **ALSO** send me a **FREE** copy of your booklet *"Some good things to know about Metal Cleaning."*

*Name*_____

*Company*_____

*Address*_____



They ARE LOCALLY AVAILABLE!

Bunting Standard Stock Bearings

The bronze bearings you need are as readily available as the Bunting catalog in your desk drawer. It gives all dimensions of hundreds of sizes of Bunting Standard Stock Bronze Bearings. Completely machined and finished, they meet every familiar requirement in production and maintenance of industrial machinery. Your local Bunting distributor carries comprehensive stocks at all times. Bunting factory branches in all industrial centers give strong and constant support to distributors.

The Bunting Distributor

Your Bunting Distributor is an industrial distributor or a specialist in certain industrial items. You will find him listed in the classified section of your telephone book—most likely under the heading Bars, bronze or Bearings, bronze. If he is the leading distributor, he almost certainly is the Bunting Distributor. He carries in stock, for your money saving convenience, completely machined and finished Bunting Standard Stock Industrial Bearings, Electric Motor Bearings and Precision Bronze Bars in a complete range of sizes meeting all your usual production and maintenance needs. Ask him for catalog.

Bunting®

BRONZE BEARINGS • BUSHINGS • PRECISION BRONZE BARS

THE BUNTING BRASS & BRONZE COMPANY • TOLEDO 1, OHIO • BRANCHES IN PRINCIPAL CITIES

TOOL STEEL THAT OUTWEARS OTHERS 3 TO 1 NOW COMES IN HOLLOW BAR FORM

ADVANTAGES OF GRAPH-MO

MOST STABLE TOOL STEEL MADE
OUTWEARS OTHERS 3 TO 1
MACHINES 30% FASTER
MINIMUM TENDENCY TO PICK UP, SCUFF OR GALL
UNIFORM RESPONSE TO HEAT TREATMENT

PLUS

ADVANTAGES OF HOLLOW BARS

NO DRILLING
FINISH BORING IS FIRST STEP
LESS MACHINING TIME
LESS SCRAP LOSS
MORE PARTS PER TON OF STEEL

EQUALS

ADVANTAGES OF

"GRAPH-MO HOLLOW-BAR"

It's "Graph-Mo® Hollow-Bar"!

NEW "GRAPH-MO HOLLOW-BAR" COMBINES THE FASTER MACHINING AND LONGER WEAR OF GRAPH-MO WITH THE ECONOMY OF A HOLLOW BAR SECTION

Now you can get Graph-Mo® graphitic tool steel in hollow bars! It's "Graph-Mo Hollow-Bar"—a new product developed by the Timken Company for makers of ring gages, dies and other ring-shaped tool steel parts.

"Graph-Mo Hollow-Bar" gives you all the proven advantages of Graph-Mo steel *plus* the economies of a hollow bar section. The hole is already there. Drilling is eliminated. Finish boring is your first step. You save machining time, cut scrap loss, get more parts per ton of steel.

Long used in bars and forgings by tool and die makers, Graph-Mo is a *different kind* of tool steel. Free graphite in its structure makes it 30% easier to machine. And the combination of free graphite and diamond-hard carbides give it unusual wear resistance. User reports prove it outwears other tool steels an average of 3 to 1!

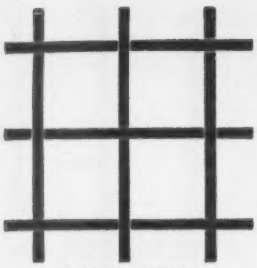
Stability tests show that Graph-Mo is the most stable tool steel made — a typical Graph-Mo steel master plug gage showed less than 10 millionths of an inch dimensional change in 12 years! Its free graphite gives it minimum tendency to pick up or gall. And it has uniform response to heat treatment.

If you make ring-shaped tool steel parts, make use of the double-barreled advantages of "Graph-Mo Hollow-Bar". Sizes range from 4″ to 16″ O. D. with a variety of wall thicknesses. "Graph-Mo Hollow-Bar" is distributed through A. Milne and Company and Peninsular Steel Company warehouses.

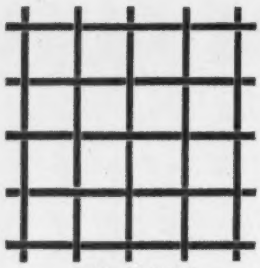
Get complete information today. Write The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

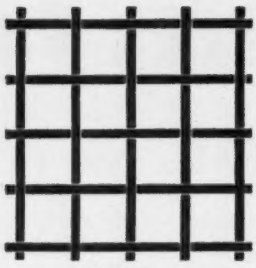
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING



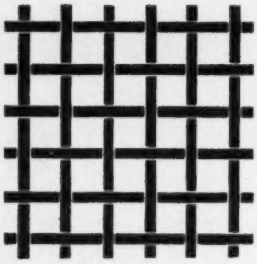
2 Mesh .063"
76.4% Open Area



3 Mesh .041"
76.7% Open Area

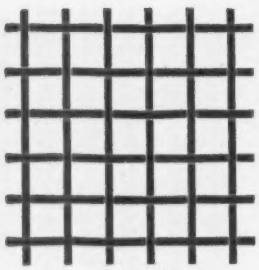


3 Mesh .054"
70.1% Open Area

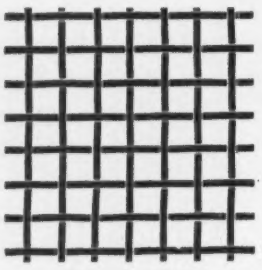


4 Mesh .063"
56.0% Open Area

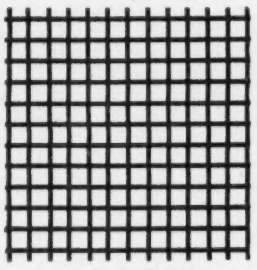
CALL CHASE



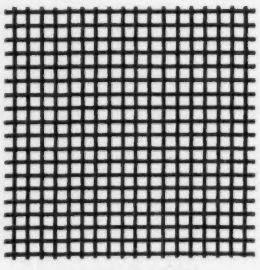
4 Mesh .047"
65.9% Open Area



5 Mesh .041"
63.2% Open Area

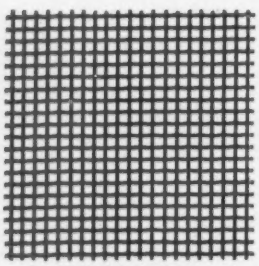


8 Mesh .028"
60.2% Open Area

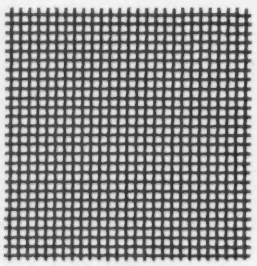


12 Mesh .023"
51.8% Open Area

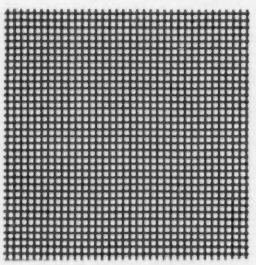
FOR INDUSTRIAL WIRE CLOTH



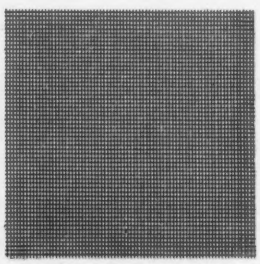
14 Mesh .020"
51.0% Open Area



18 Mesh .017"
48.3% Open Area



24 Mesh .0135"
45.8% Open Area



50 x 40 Mesh .009"
35.7% Open Area

IN BRASS AND COPPER

From coarse wire cloth for window or door grilles . . . right down to extra-fine mesh for food preparation, call Chase.

Double crimped wires of Chase Wire Cloth keep openings square and true . . . mesh uniform. It is woven in a mill which specializes in weaving brass, copper and copper-alloy wire cloth. The result is *quality*.

For information on the size and type wire cloth you need, send for free book or call your nearest Chase warehouse.

Chase®

BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany†	Chicago	Denver†	Kansas City, Mo.	Newark	Pittsburgh	San Francisco
Atlanta	Cincinnati	Detroit	Los Angeles	New Orleans	Providence	Seattle
Baltimore	Cleveland	Houston	Milwaukee	New York	Rochester†	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(†sales office only)

They're still talking in shops that use

J&L "1200"

COLD FINISHED STEEL

Shop records keep proving the logic of using **J&L "1200"** COLD FINISHED STEEL in terms of

SUPERIOR MACHINABILITY

HIGHEST QUALITY FINISHES

DEPENDABLE UNIFORMITY

EXCEPTIONAL EFFICIENCY

from machines and operations

The list of shops making J&L "1200" Cold Finished Steel a permanent specification keeps growing. Production records prove—again and again—that here is a new, free-cutting steel with exceptional machinability and uniformity.

There are two things you should do today:

1. Obtain complete information concerning J&L "1200" Cold Finished Steel.
2. Try J&L "1200" Cold Finished Steel in your production line.

Here's a booklet that will help you . . .
SEND FOR YOUR COPY TODAY!

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH

Jones & Laughlin Steel Corporation
473 Gateway Center
Pittsburgh 30, Pa.

I'd like a copy of your booklet "J&L 1200 Cold Finished Steel."

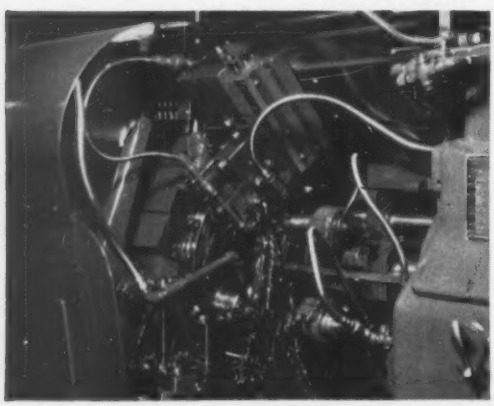
NAME_____

COMPANY_____

ADDRESS_____

Free-Machining ENDURO STAINLESS STEEL BARS

...two Grades Fully 90% As Machinable As Bessemer Screw Stock



You can give duplicate steel parts added strength and increased corrosion-resistance . . . and still get economical automatic production. Convert to Free-Machining ENDURO Stainless Steel bars. They're cold-finished by Republic's Union Drawn Steel Division to give you close tolerance, accuracy of section, uniform soundness and fine surface finish . . . plus the high physical and chemical properties of stainless steel. Two grades are fully 90% as machinable as regular Bessemer screw stock. Free-Machining ENDURO is also available in hot-rolled bars and wire. Republic metallurgists give prompt assistance on applications, processing and use. Write:

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic ENDURO® FREE-MACHINING STAINLESS STEEL

REPUBLIC STEEL

Other Republic Products include Carbon and Alloy Steels—Pipe, Sheets, Strip, Plates, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

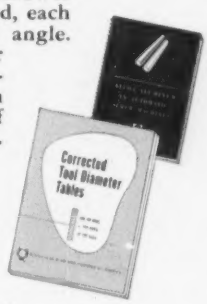
Deep drilling aluminum is easy when you follow ALCOA'S recommendations

Deep drilling can be done in any of the standard Alcoa Screw Machine Alloys. They combine a wide range of properties—strength, corrosion resistance, finishability. But if deep drilling is most important, choose 17S-T4.

Use straight fluted drills for average depth holes. Use either slow or high spiral drills in 24S-T4 and 61S-T6. All three drills have wide flutes that readily pass up the chips. For very deep holes use a standard drill to a depth of about 3 diameters, then follow with a half-round drill.

You'll increase drill life and reduce heat by thinning the margins along the edges of the drill flutes. As the drill is ground back, the web should be thinned at the point. In deep hole drilling the included angle should be larger than the standard 118°. This produces a narrower chip that clears easily. When several drills are used, each succeeding drill should have a larger included angle.

Your local Alcoa sales engineer will answer your questions on machining, alloy selection and finishing. You'll find him listed under "Aluminum" in your classified phone book. Aluminum Company of America, 870-F Alcoa Building, Pittsburgh 19, Pa.



ALCOA OFFERS TWO BOOKS *Alcoa Aluminum in Automatic Screw Machines*—a 95-page book containing information on tool design, setup and operating techniques. *Corrected Tool Diameter Tables*—a 64-page book giving corrected tool diameters for circular form tools and flat form tools under conditions of 0°, 5° and 10° top rake.

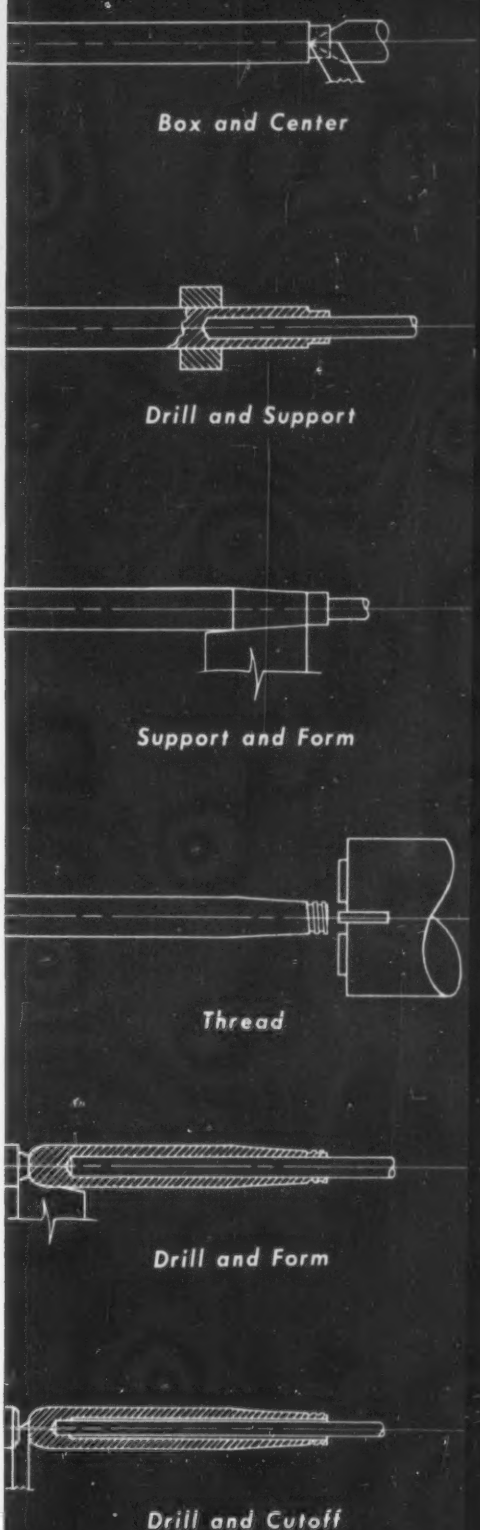
BASIC ECONOMICS FOR BUYERS

While you buy screw machine stock by the pound, you machine it by the foot. A pound of aluminum gives you three times more feet of stock than a pound of brass or steel.

Alcoa Aluminum

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA



Acid Disc Inspection backed by *Ultrasonic Testing* is just one of many Carpenter quality controls.

IF YOU USE TOOL STEEL, THESE ARE FACTS YOU SHOULD KNOW

When you make or use a tool or die you invest a sizable sum of money. And there are steps you normally take to protect your investment. You make sure the design is right. You follow through with accurate toolmaking and correct heat treating. But there is *one* factor involved in the success of your die, over which you have only indirect control. That factor is the *soundness* of the die steel you start with. After all, if the steel itself isn't right, you needlessly risk your entire investment.

How can you be *sure* the die steel you use has what it takes to assure good tools? The answer lies in the painstaking controls regularly practiced by the steel manufacturer. Listed here are the four important tool steel controls pioneered by Carpenter to give steel users like yourself the protection you need. Before you place that next tool steel order, ask yourself, "Does our steel supplier guarantee these four quality controls in the die steel we use?" Then remember: You can be *sure* of them when you specify Carpenter Matched Tool and Die Steels. And you don't pay anything extra! THE CARPENTER STEEL COMPANY, 105 W. Bern St., Reading, Pa.

4 Tool and Die Steel Developments *Pioneered by Carpenter* Help Carpenter Customers Cut Costs, Improve Die Performance

Since 1929:

HOT ACID DISC INSPECTION has been standard practice at Carpenter. To Carpenter customers it provides full assurance that Matched Tool and Die Steels are internally sound, shipment after shipment.

Since 1930:

The TOUGH TIMBRE TEST has assured Carpenter users a wider safe hardening range, greater dependability in performance.

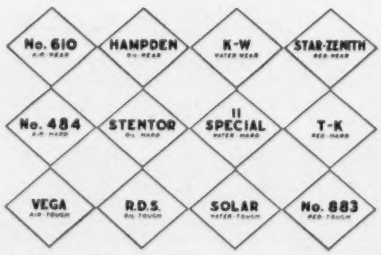
Since 1933:

The TORSION IMPACT TEST has provided Carpenter Matched Tool and Die Steel users with more complete heat treating information that leads to better tools and dies.

Since 1940:

The CONE TEST, used to check and control hardenability of Carpenter water-hardening Matched Tool and Die Steels, has made sure that sections of the same size have uniform hardness penetration in lot after lot.

Carpenter STEEL Matched Tool and Die Steels



Export Department: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"

Mill-Branch Warehouses and Distributors in Principal Cities Throughout the U.S.A. and Canada

matchless performance

when the chips are down!

High Speed Steels

BY **Vanadium-Alloys**

VASCO SUPREME — Highest hardness, highest wear resistance, supreme in the field. (U.S. Pat. 2174286).

NEATRO — Resistance to abrasion exceeds all steels except Vasco Supreme. Excels for both heavy and light cutting.

VAN CUT — High carbon, high vanadium. Properties intermediate between Vasco M-2 and Neatro for easier grinding. Suitable for all types of cutting tools.

RED CUT SUPERIOR — The nation's best known general-purpose steel. Readily fabricated and heat treated. Shines in a host of applications.

VASCO M-2 — The original 6-6-2 type steel. Wide hardening range, good machining characteristics, outstanding economy in service.

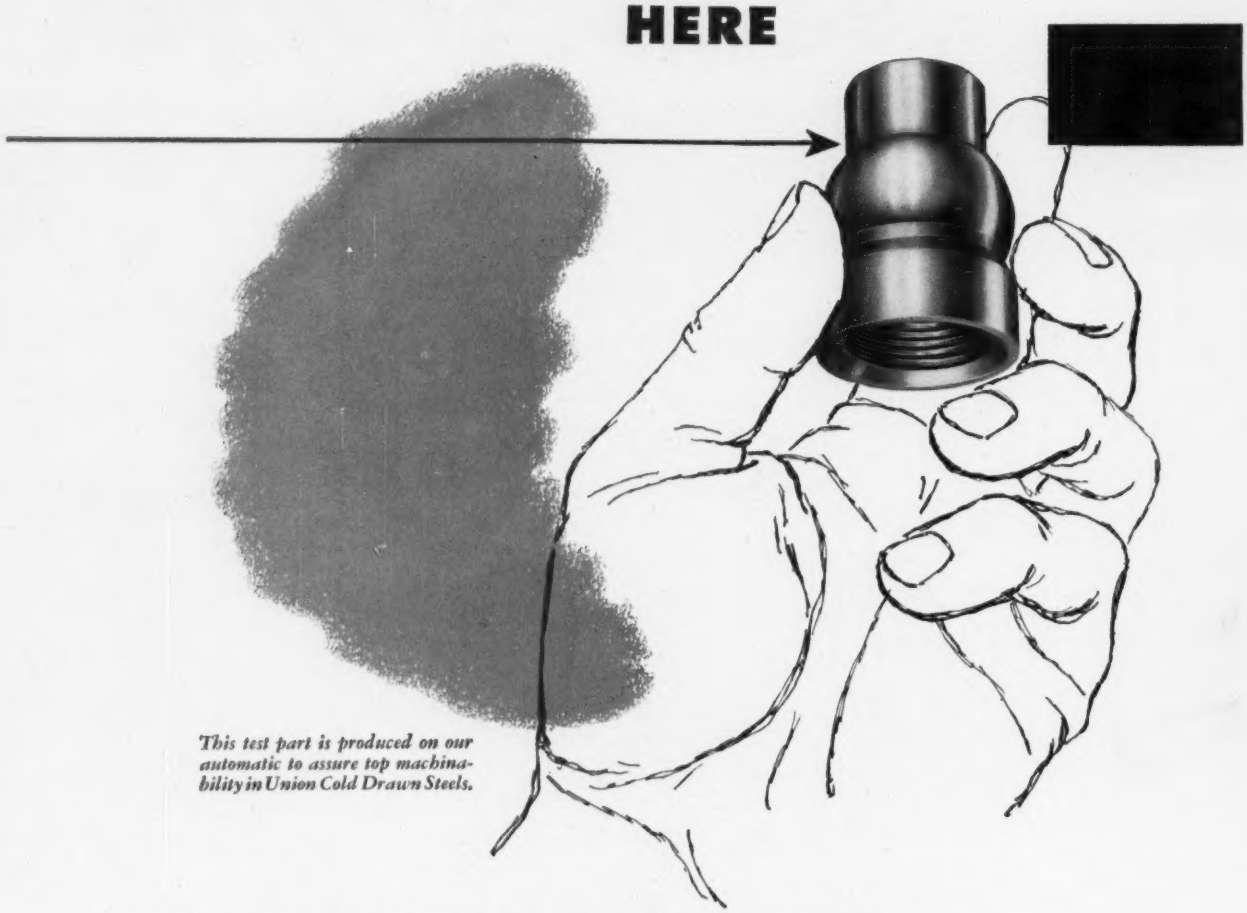
8-N-2 — Low tungsten, high molybdenum, very tough at high hardness. Excels for fine edged tools.

VAN-LOM — High molybdenum, high vanadium. Best cutting performance of all high molybdenum steels.

Write for your free copy of our comprehensive HIGH SPEED STEELS Catalog — grades, applications, heat treatment — helpful, complete!

Vanadium-Alloys
STEEL COMPANY
LATROBE, PA.
COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL COMPANY

PRE-TESTED MACHINABILITY HERE



This test part is produced on our automatic to assure top machinability in Union Cold Drawn Steels.

What we learn about Union Cold Drawn Steels on our automatic screw machine at Massillon, Ohio, helps you make a better product at a better profit when you cut those steels on *your* automatics.

That's why Union Drawn's "Pre-Tested Machinability" idea keeps set-up men and operators happy when they're running Union Cold Drawn Stock . . . they get set-up sooner, with fewer headaches, using the best combinations of feed and speed. There are more parts in the shipping pan, fewer parts in the reject box. Profits stay up, costs stay down.

And it's all because we have an automatic! It runs all day long, doing the six most common operations on the useless part above. Useless to everybody except to us at Union Drawn . . . and to you who use Union Cold Drawn Stock.

Our Union Drawn Field Metallurgists would welcome the chance to talk with your set-up man, swap hints on tool angles, heavier feeds, faster speeds. When shall we call?

REPUBLIC STEEL CORPORATION
Union Drawn Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

REPUBLIC STEEL

6 HELPFUL MANUALS

filled with how-to-do-it information and data to help you use Union Cold Drawn Steels. Write for "Union Drawn Pocket Library."

Republic UNION® COLD DRAWN STEELS

Free-Machining Bessemer, Alloy and Enduro Stainless Steels

•

Union Cold Drawn Special Sections

•

Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting.)

IN FOR A LIFE OF HARD LABOR

Shown here are several types of Bethlehem rolled-and-forged circular blanks which are, as you can see, very sturdy specimens. They will be used in different kinds of work, but one and all, they are in for a life of hard labor.

These blanks, and all similar blanks made by Bethlehem, are strong and homogeneous—strong, tough steel from rim to rim. You'll find them perfect for gears, crane wheels, sheave wheels, turbine rotors, flywheels, and other rugged parts that work day in, day out under very heavy loads.

A special process involving both rolling and forging produces uniform density of metal and an excellent grain flow. As a result, something more than strength is achieved. Because of the firm, solid steel all the way through, the blanks machine dependably and easily, with no hidden trouble down beneath. No flaws that can mean discarding a piece after expensive preliminary cuts have been taken.

And speaking of machining: we furnish the blanks rough-machined, so that there's a minimum of finishing work for you, the customer.

Bethlehem circular blanks are available untreated or heat-treated, in sizes ranging from approximately 10 to 42 in. OD. Ask for particulars—or write for a free copy of illustrated Booklet 216.

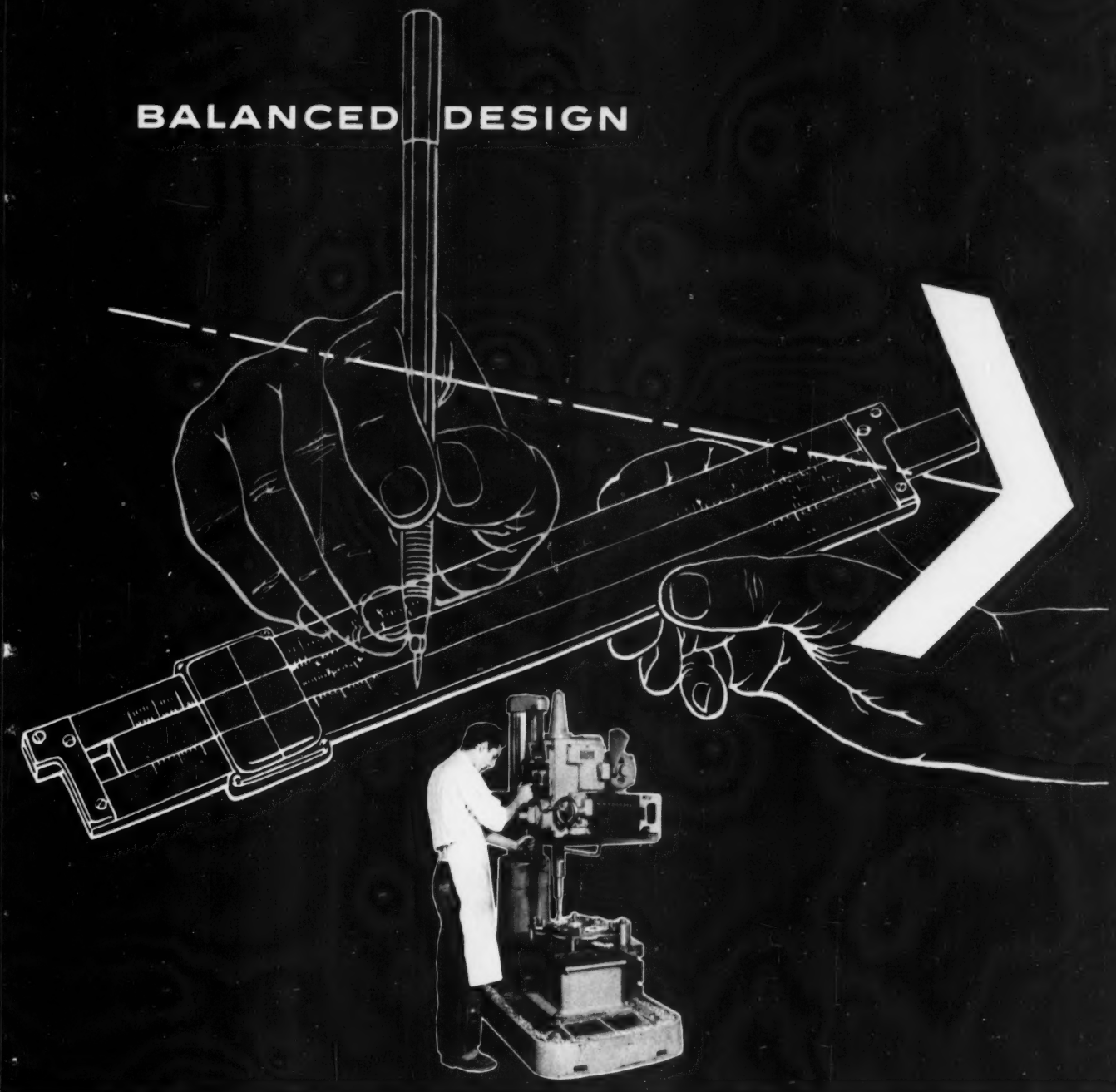
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM ROLLED-and-FORGED CIRCULAR PRODUCTS

BALANCED DESIGN



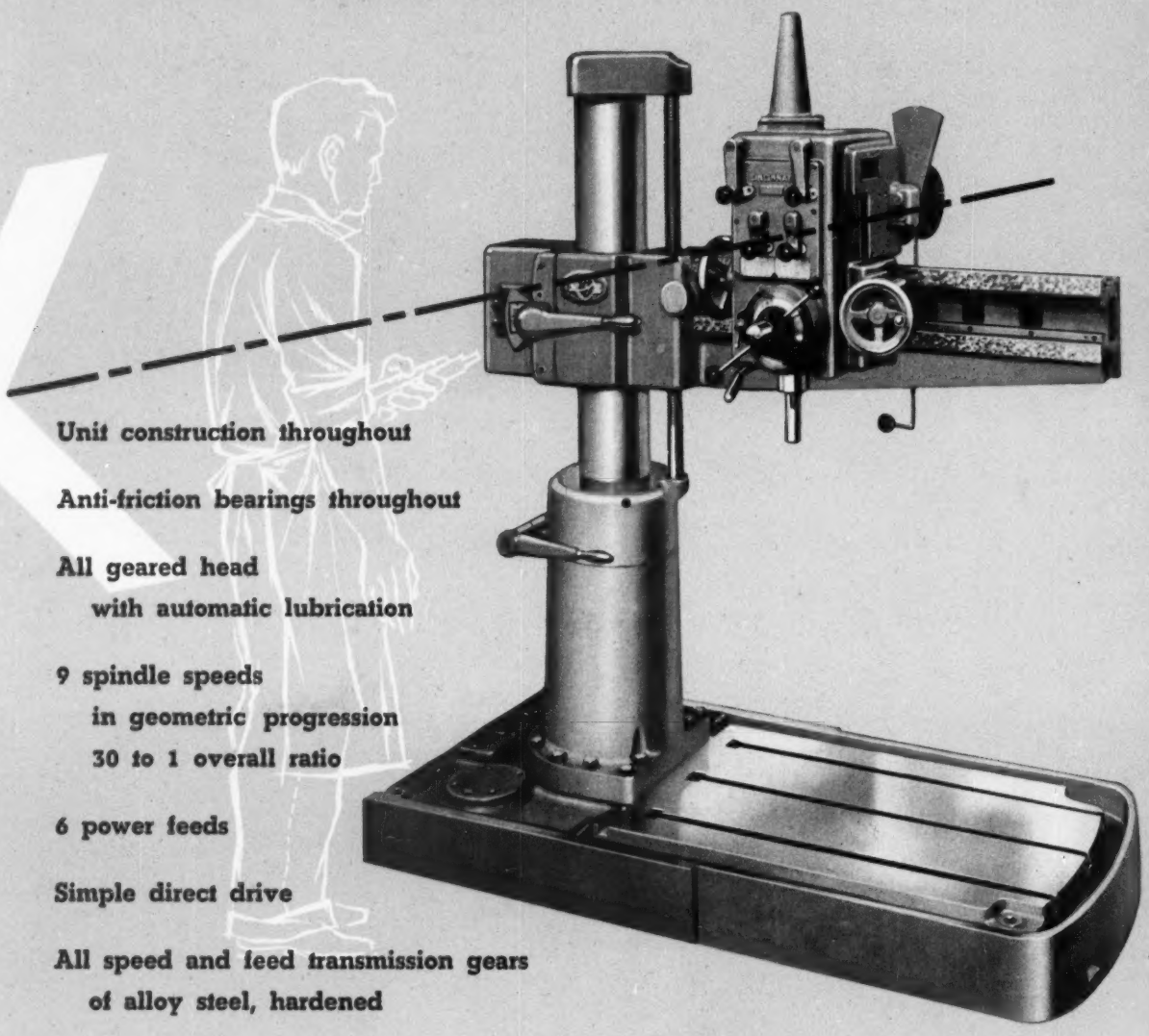
We're getting reports from all over the country on how operators really like the new 3' Arm 7" Column Radial Cintidrill. The smooth way it "handles" . . . the wide range of jobs within its 1-inch capacity . . . its round-the-clock reliability – can all be summed up as BALANCED DESIGN. It'll be worth a check right soon on how this new economy-priced radial can smooth out drilling schedules and save money for you.

best buys in their class!

CINTIDRILL

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.

MORE **QUALITY** FEATURES



Unit construction throughout

Anti-friction bearings throughout

All geared head
with automatic lubrication

9 spindle speeds
in geometric progression
30 to 1 overall ratio

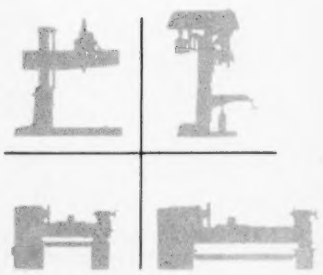
6 power feeds

Simple direct drive

All speed and feed transmission gears
of alloy steel, hardened

This cost-saving radial is just one of the complete balanced line of Cintidrills, including 21" sliding head box and round column floor drills; 14" 3000 and 16" 3000 sliding head bench and floor drills; 16" and 18" Royal Cintidrills, bench and floor models, single and multiple spindles. Write for catalogs and name of your nearest dealer.

best buys in their class!



CINTIDRILL

CINCINNATI LATHE & TOOL CO., CINCINNATI 9, OHIO, U. S. A.

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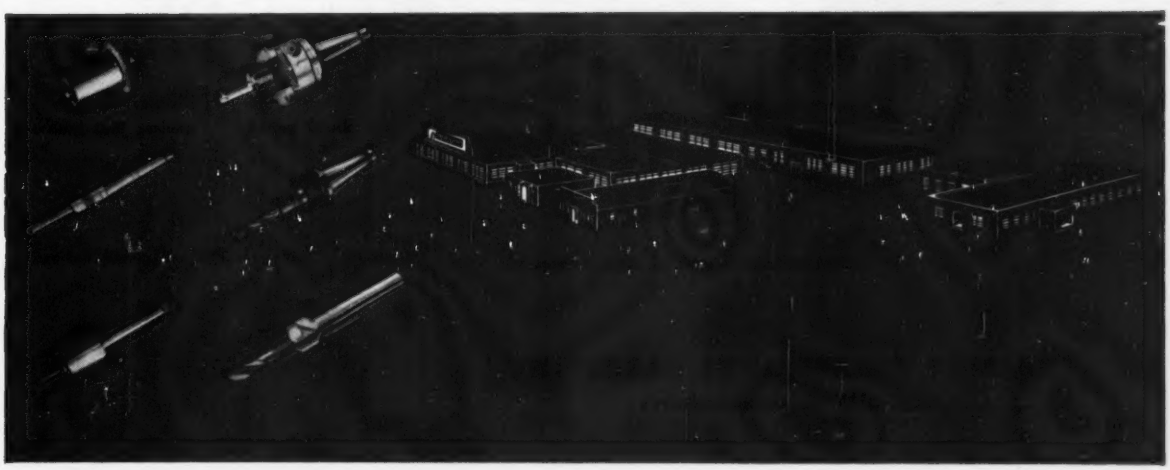
COMPLETE VARIETY OF

SIZES AND LENGTHS IN

UNIVERSAL SUPER FINISHED

DRILL BUSHINGS

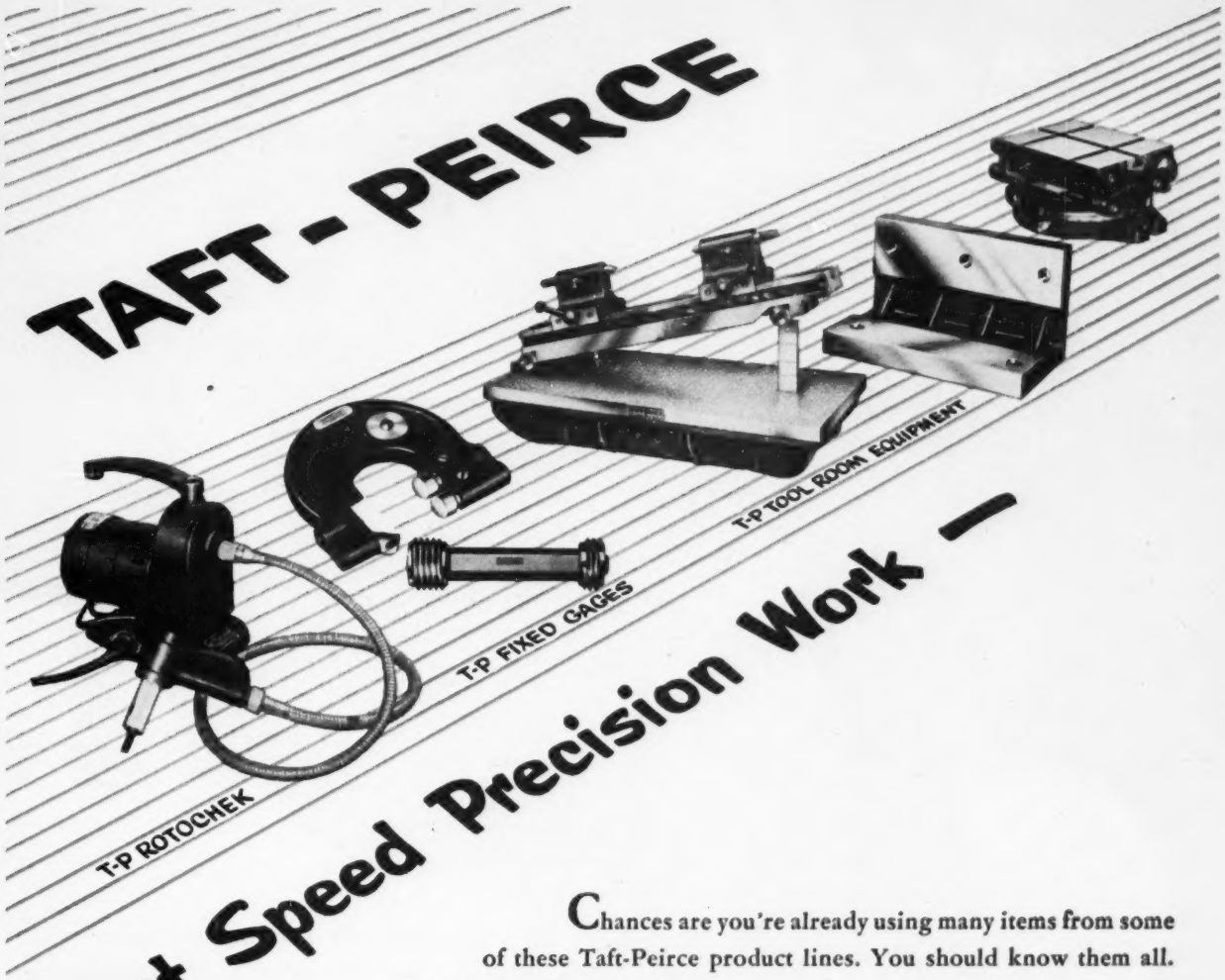
Check these features that make Universal drill bushings outstanding: 1. Super finish reduces wear to a minimum. 2. Blended radius reduces tool hang up. 3. 100% concentricity and hardness tests assure accuracy. 4. Knurled head provides quick sure grip. Order from the office nearest you ... 1060 Broad St., Newark, N.J., 5035 Sixth Ave., Kenosha, Wis., or write direct to our home office.



THIS IS STANDARD AT

Production and Inspection Tools

TAFT-PEIRCE



That Speed Precision Work —

Chances are you're already using many items from some of these Taft-Peirce product lines. You should know them all. Each has certain exclusive advantages that set it apart from competitive products. Many of them are actually not competitive at all — since in their own specific field of application nothing else compares. For example:

T-P Superpower Magnetic Chucks pack more power in less space.

T-P #1 Surface Grinders and Lapping Machines easily produce surfaces with an accuracy, flatness, and finish previously considered difficult or impossible.

T-P CompAIRator measures a wider range and variety of work than any other air gage. The COMPUTING CompAIRator also solves simple problems, and indicates the result on the dial-face.

T-P Rotochek, a valuable adjunct to the T-P line of fixed gages, is the fastest thread gaging method ever devised. Push — and the gage enters the work. Pull — and it disengages.

T-P Tool Room Equipment includes many special time-and-labor-saving items such as taper testing fixtures and adjustable angle plates to mention only two.

Each of these products is part of a complete Taft-Peirce line. Available in standard or special models tailored to your needs. Full details are described in the new Taft-Peirce Handbook. Write for your copy today.

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND

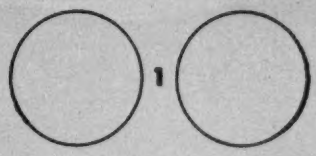
NIAGARA Inclinable Presses

Niagara Inclinable Presses with Air Sleeve Clutch cannot be matched for economy, efficiency and dependability on jobs requiring high frequency clutch engagement.

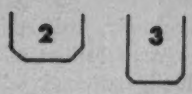
Write for information.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

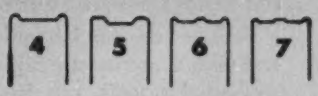
On the Production Line



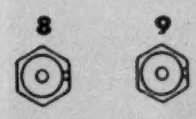
1. Punching two round blanks per stroke on Niagara A-5½ Press with Air Sleeve Clutch.



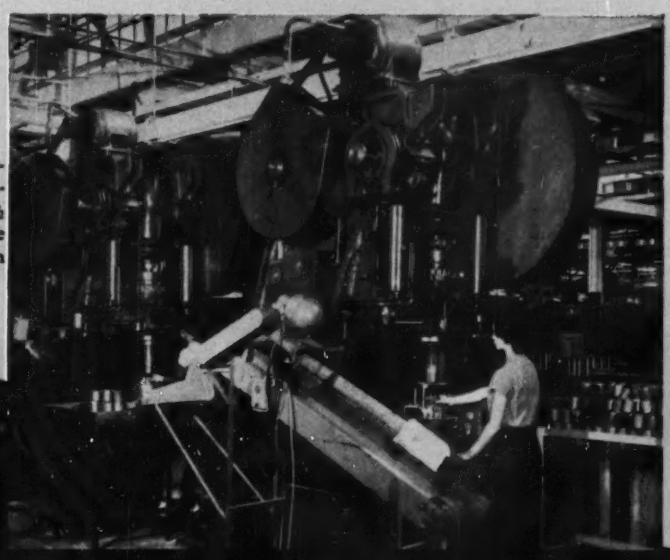
2, 3. Cupping and Redrawing on A-5½ Presses with Air Sleeve Clutches.



4, 5, 6, 7. Indenting end on A-3½ Presses.



8, 9. Forming hexagonal shape and Ironing side wall on A-5½ Presses with Air Sleeve Clutches and with Niagara Cushions.



The final piercing and tapering operations are done on A-3½ Presses (not shown.)

NIAGARA

America's Most Complete Line of Presses, Shears, Machines and Tools for Sheet Metal Work

DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK • PHILADELPHIA

Dealers in principal U. S. cities and major foreign countries

WHEN SMALL PARTS GET

SMALLER

AND TOLERANCES GET

CLOSER

YOU NEED . . .

BECHLER

SWISS AUTOMATICS

Bechler Model A-10—
⅜" capacity.

When tolerances are too tight, and parts are too slender or intricate to be produced on ordinary screw machines, then Bechler genuine Swiss Automatics are probably what you need. Fifty years of experience have made Bechler the leading builders of Swiss type Automatics—and BECHLERS are SWISS-MADE.

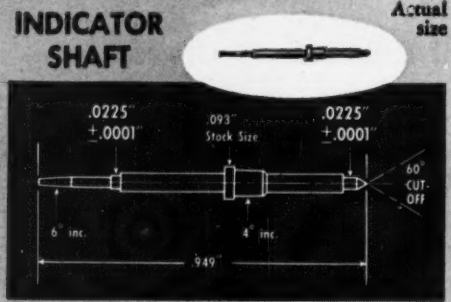
Bechlers do the job quickly, accurately, uniformly, and with exceptionally high finish. Five tool slides, with single-point tools, can be individually adjusted with micrometer screws. The two horizontal slides of the double tool attachment are used for undercutting and burnishing. Different models are available with capacities up to 1¼" diameter and 9" turning length.

Get in touch with us soon. Find out how Bechler can help you make better products to meet and beat higher and higher standards.

- **Service centers in New York and Los Angeles—factory trained men will plan layouts, produce tools, cams, and make set-ups.**
- **Complete stock of attachments, spare parts, and cams.**

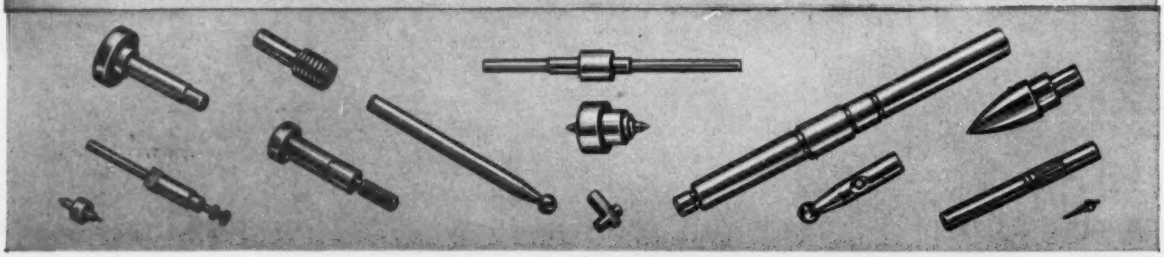
INDICATOR SHAFT

Actual size



material	stainless steel, type 303
precision	bearing diameters held to ± .0001"
finish on bearing surfaces	6 MIRMS
production time	30 seconds per piece
machine	Bechler, Model A-10

The Bechler Model A-10 can produce many different precision parts up to ⅜" dia., 2¾" long. Here are just a few, actual size:



COSA CORPORATION

405 Lexington Ave., New York 17

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

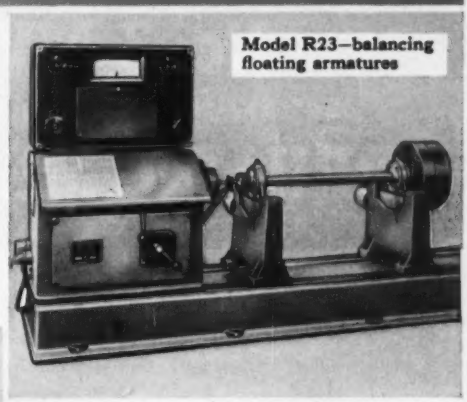
PRODUCTION . . . BALANCING

WITH

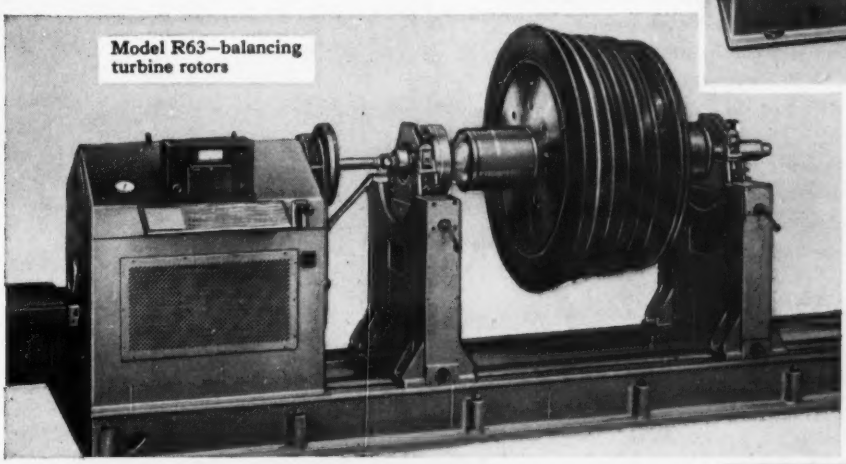
SCHENCK

ELECTRO-DYNAMIC BALANCING MACHINES

Now, in a fraction of a minute and in a single run, you can accurately determine the amount and location of dynamic and static unbalance on rotating parts. The SCHENCK Electro-Dynamic Balancing Machine has a sensitive and accurate electrical measuring system—without electronic tubes or oscillograph—that will indicate unbalances caused by displacements as little as 0.00004" from the center of gravity. Simple and easy to operate, the SCHENCK Balancer, by coordinate measurement, quickly indicates on a Wattmeter the unbalance of the rotating part.



Model R23—balancing floating armatures



Model R63—balancing turbine rotors

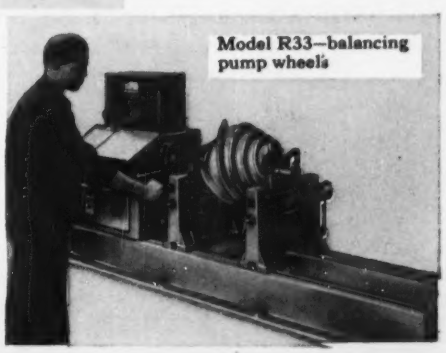
The workpiece is balanced easily by adding or removing weight units at two of the four balancing points located within the coordinates, 90 degrees apart. For many production installations, Schenck Balancers combined with machine tools—check, correct and inspect parts in one set-up.

SCHENCK ELECTRO-DYNAMIC BALANCING MACHINES ARE THE RESULT OF 40 YEARS WORLD-WIDE EXPERIENCE. THEY ARE MADE IN MANY CAPACITIES TO BALANCE ROTATING PARTS WEIGHING UP TO 100 TONS.

Machine Type	R13	R23	R33	R43	R53
Measuring Range (Weight of part in lbs.)	.1-22	.3-66	1-220	3-660	11-2,200

Machine Type	R63	R73	R83	R93
Measuring Range (Weight of part in lbs.)	33-6,600	110-22,000	330-66,000	1100-220,000

Let Cosa Engineers recommend the proper Schenck Balancer for your needs. Or, send for detailed catalog.



Model R33—balancing pump wheels

COSA CORPORATION

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IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

Take the load off your

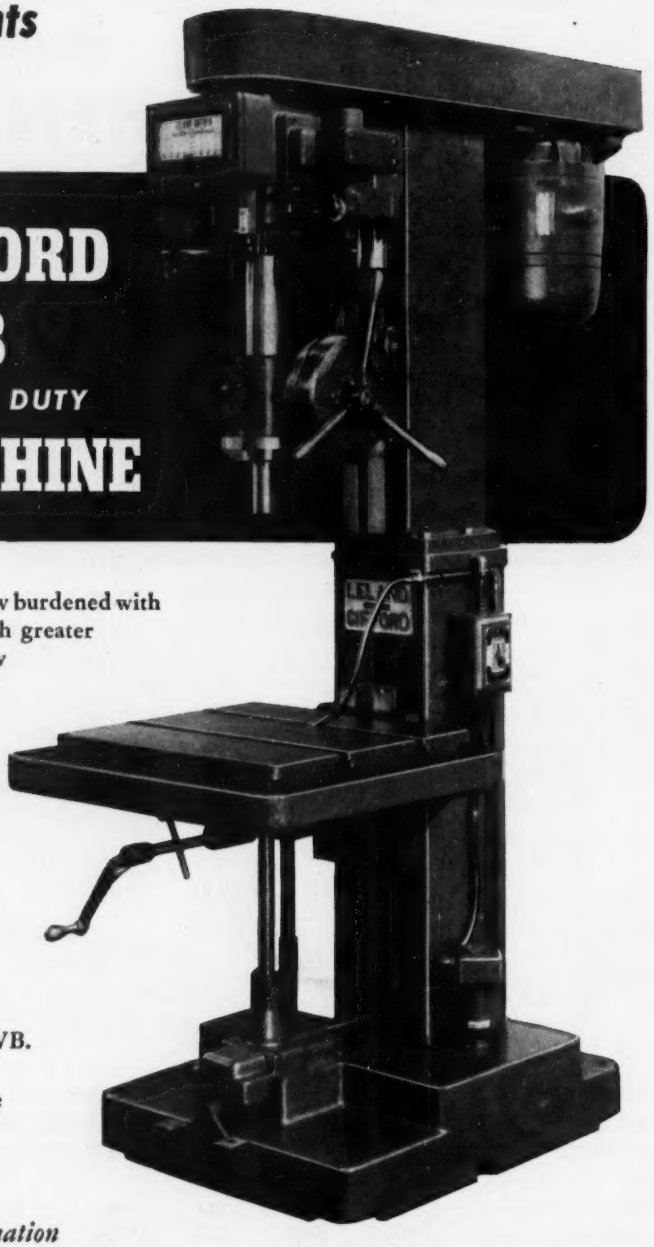
Radials and Uprights

with the NEW

LELAND-GIFFORD No. 3 MVB

24" SWING — HEAVY DUTY

DRILLING MACHINE



Many a radial or heavy duty upright is now burdened with operations which can be performed with greater speed, economy and efficiency on the new Leland-Gifford No. 3 MVB. Rugged, powerful, versatile, it will handle holes up to 1¼" in steel or 1½" in cast iron. Available with one to four spindles; power, hand or hydraulic feed; two or eight speeds with single or four speed motor and back gearing — it is adaptable to any general purpose or mass production drilling, tapping, reaming and counterboring assignment.

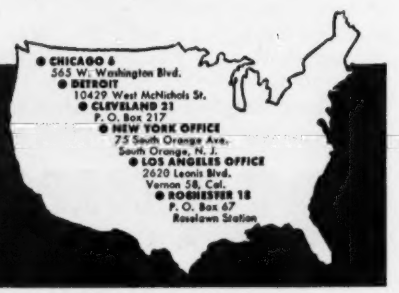
Look into the Leland-Gifford No. 3 MVB. It will not only pay for itself quickly — but give you an extra bonus by taking the load off more costly equipment.

Write for Complete Information

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.



FEDERAL has *Everything* in COMPARATORS

A *BRAND NEW*

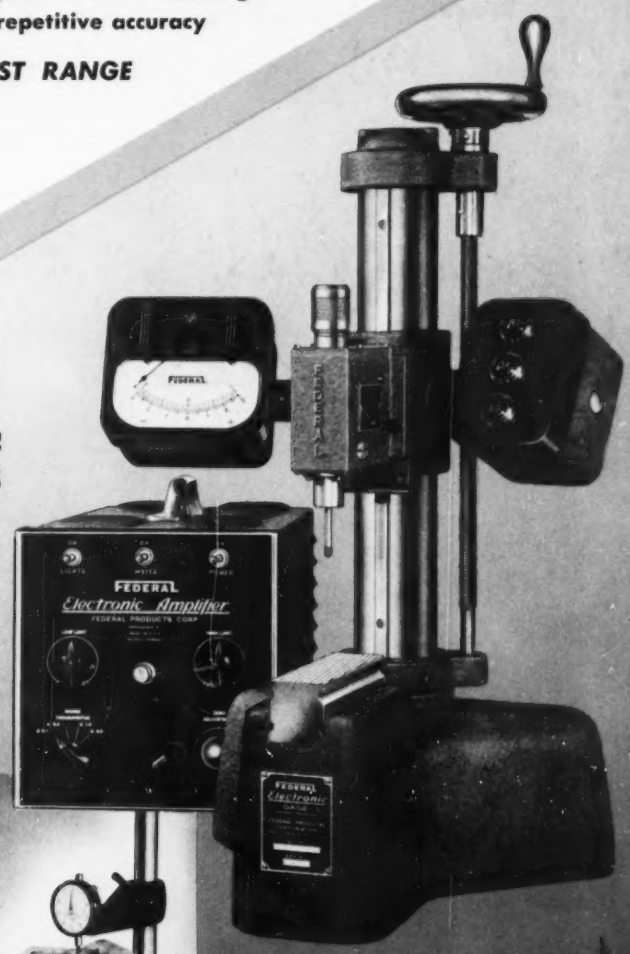
Higher Precision MASTER COMPARATOR

For Inside and Outside Dimensions

THIS INSTRUMENT PROVIDES the ultimate in practical high-precision dimensional comparison. Its friction-free sensitivity assures a repetitive accuracy that makes possible an extremely high degree of fine measurement. Also, greater relative magnification, and measuring range, together with positive rigidity and ease of operation, make this Comparator an exceptional measuring instrument.

- **Magnification from 500X to 15,000X**
- **Constant contact pressure**
- **Fast, positive meter reading**
- **High repetitive accuracy**

LONGEST RANGE

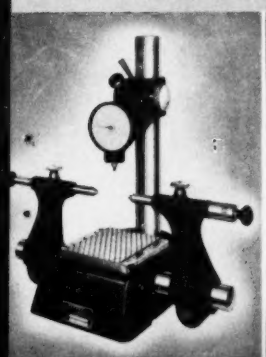


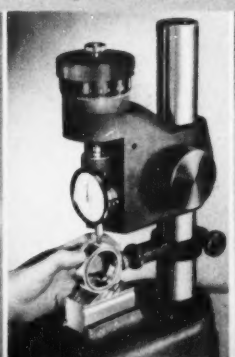
AN ELECTRONIC COMPARATOR

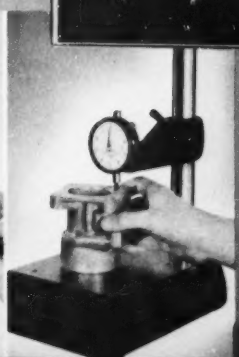
THE MORE YOU USE IT
THE MORE YOU LIKE IT

The accuracy, sensitivity, stability and versatility of this Electronic Comparator become increasingly apparent as you use it. Those who own it tell us they appreciate its all-'round practicality more and more the longer they own it.

A few other Comparators (Send for Catalog)

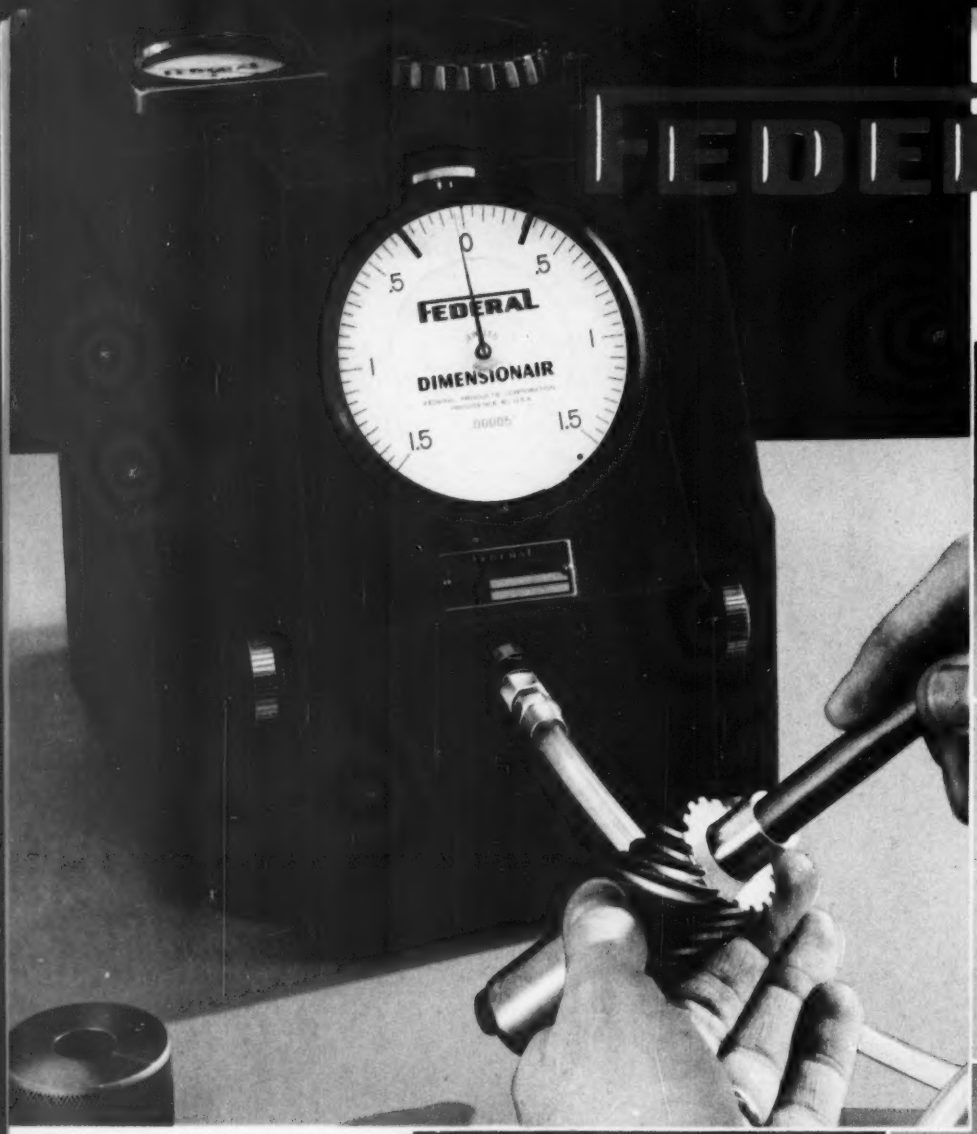


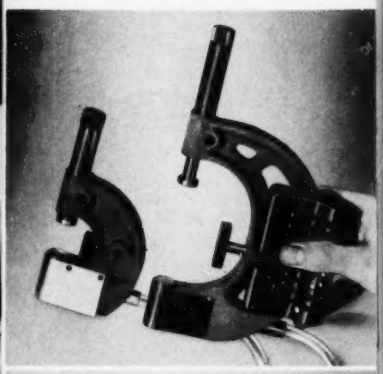




SEE INSIDE FOR MORE GAGES

FEDERAL





AIR and ELECTRONIC

The hole is measured by air and the measurement is classified by the electronic circuit into one of 18 categories. The gage then *automatically* stamps the size on each workpiece for future identification.

(*Above*) Explores inside diameter for taper, out-of-round and bellmouth, etc., over total length of workpiece. Dial Indicator checks distance from bottom of bore to outside shoulder.

(*Above, right*) These two six-jet air plugs gage thin-walled workpieces for average diameter. Especially applicable to work which may be distorted when fitted to its component.

Single jet air plug inspects accuracy of location of three holes in workpiece in relation to the two large locating spindles on the master fixture. An excellent gage for gear box, meter and pump housings.

DIMENSIONAIR

has *Everything* YOU NEED in an AIR GAGE

AIR SNAPS

Air Snaps are adjustable for size and made to cover all dimensions. Measuring contact is mechanical — not a jet.

THE DIMENSIONAIR IS REALLY AN OUTSTANDING AIR GAGE. Not only is it unique in its basic repetitive measuring accuracy, stability and longer range per magnification, but it is set to zero in a second and requires a minimum of maintenance. Changing plug sizes is much quicker. Resetting zero is a matter of seconds . . . no fiddling around.

Now Dimensionair, combined with electronics, is used for automatic sorting gages (See lower left illustration).

Because only a Single Master is needed with the Dimensionair, the cost of *two* masters, as required by other air gages, is cut in half. Gage at lower right required only 25 masters, instead of 50, to cover all size requirements. That's a worthwhile saving in any shop.

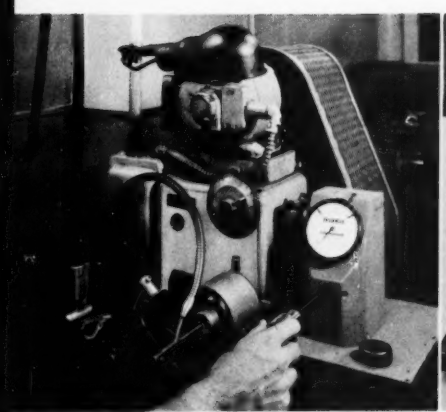
The graduated scale is accurately calibrated. It is not a scale arbitrarily divided between plus and minus tolerances. The magnification is fixed.

Three-jet air plug enables accurate inspection of out-of-round holes.

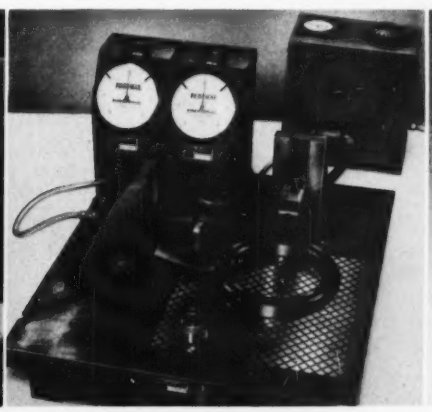
The gage plug has greater clearance and greater wear. The former makes it much easier to enter the plug in the hole. The plug wears much longer because the jets are set deeper; the greater range makes this possible.

Owners tell us there is no comparison after they have used various types of air gages. You really owe it to your plant to use the Dimensionair. Federal Products Corporation, 1144 Eddy Street, Providence 1, Rhode Island.

ASK FOR A DEMONSTRATION IN YOUR OWN SHOP



Dimensionair permanently installed on honing machine. Oil and grit do not bother the gage. The Dimensionair is ideal for this type of work.



A Dual Dimensionair gages the inner and outer faces of ball bearing raceways *indirectly by mechanical contact.*

Adjustable Air Gage for fast simultaneous inspection of Ball Bearing ID & OD over a large range of 25 different sizes up to 10 inches. Checks taper, bellmouth and out-of-round. Used for *incoming inspection.* Cost of masters was cut in half because Dimensionair requires only *one* master for each size.

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL INDICATING GAGES

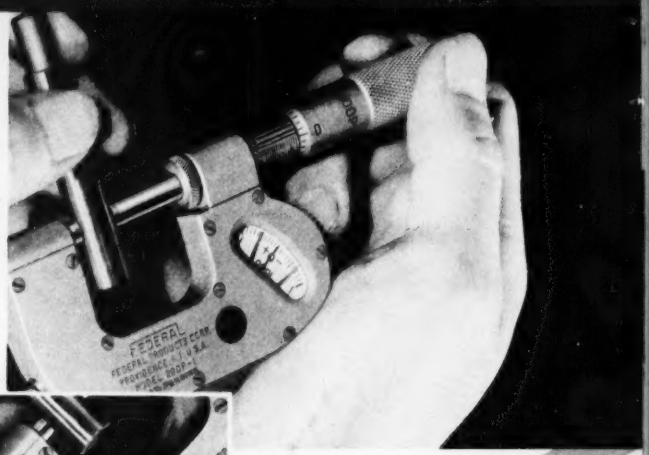
FEDERAL

has *Everything* in Gages

MIKEMASTER

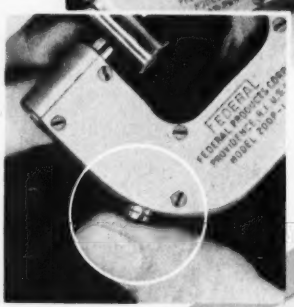
YOU MEASURE *ACCURATELY* WITH THIS *INDICATING MICROMETER*

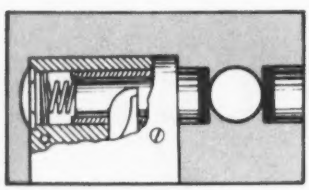
ONCE YOU HAVE USED IT you'll know you are getting more consistently accurate readings. By actual tests, four people, using a conventional style micrometer, each measured the same diameter three times and the measurements differed from .0002″ to .0008″. With the "Mikemaster", all measurements but one were exactly on the nose and the latter showed less than .0001″ variation.



YOU CAN ALSO USE IT AS A SNAP GAGE

Set Mikemaster to required dimension, set tolerance hands to tolerances,—and you can compare workpieces by inserting between anvils. Push-button retracts lower anvil for easy non-scratching insertion of workpieces . . . also saves wear on anvils.





UNIFORM PRESSURE on all measurements insures positive accuracy every time. No variation in readings because of human variation in barrel pressure or speed. Tests prove superior accuracy.

SEND FOR DESCRIPTIVE FOLDER

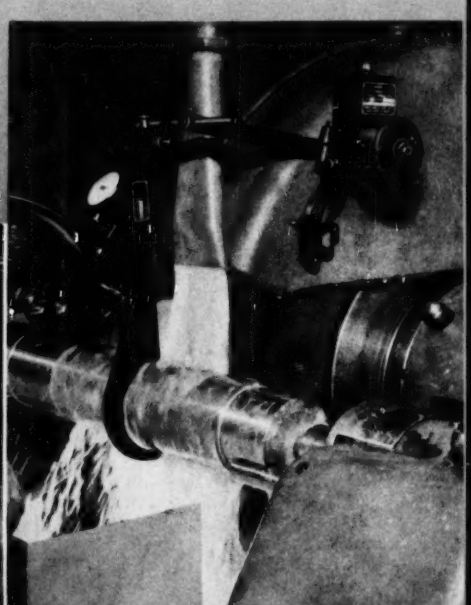
ARNOLD CONTINUOUS GRINDING GAGES

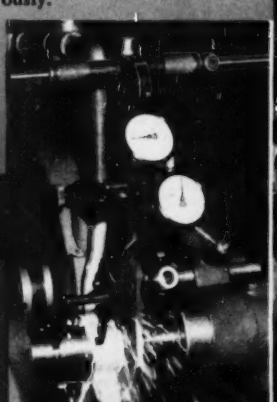
MORE OUTPUT PER MACHINE-HOUR

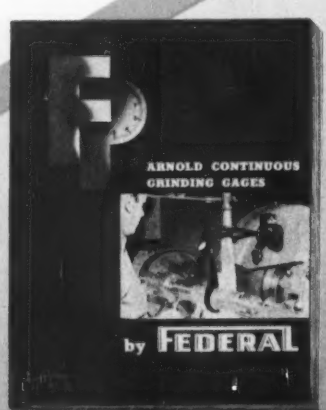
NO NEED OF STOPPING THE GRINDER to gage or "mike". The exact diameter is always visible on the Dial Indicator. "Spark-out" time is reduced. Both diameter and face, or width, can be controlled simultaneously. Gages can be interchanged quickly when gaging various diameters on the same workpiece. Work can be ground to closer tolerances at less cost and more nearly perfect interchangeability of parts can be obtained.

The Arnold Gage eliminates scrap. Positive, precise, visual size-control is obtained, independent of sizing controls of the machine.

Arnold Gage Model LWF controlling diameter and shoulder length simultaneously.







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SEND FOR COMPLETE CATALOG

Taper | Splines | Multiple Dimensions | Outside Width & Dia. | Inside Width & Dia.

FEDERAL PRODUCTS CORPORATION
PROVIDENCE 1, RHODE ISLAND

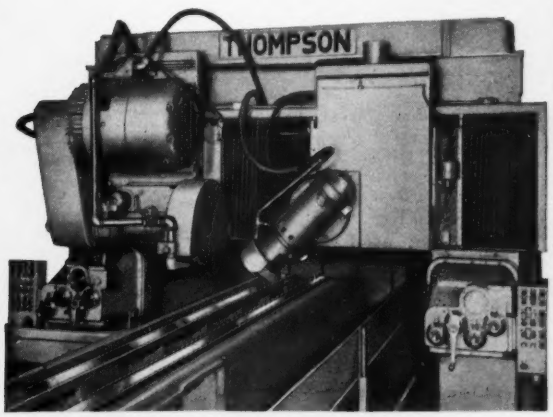
Printed in U.S.A.

New Thompson Way Grinder Developments

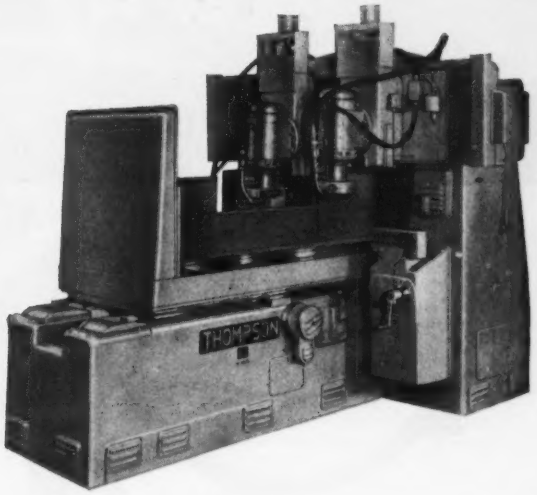
Reduce Costs ... Speed Machine Tool Production

Way Grinders now available with single, multiple heads, or combinations of horizontal and vertical heads and in sizes to meet all requirements.

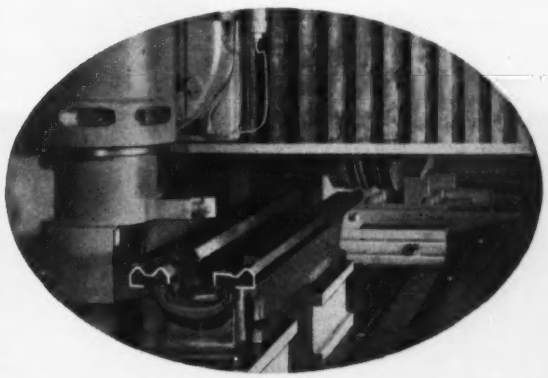
Thompson has produced machine tool way grinders in many types and sizes that have eliminated hand-work and produced economical and accurate ground ways. However, recently increased production grinding of ways has been made possible by many new Thompson Way grinding developments such as: automatic grinding and truing cycles; dual vertical or horizontal heads for grinding ways different heights; horizontal multi-wheel grinding and vertical side and undercutting head; Hydrail way grinding for giant columns or bed ways. Three of the new Thompson Way Grinders are shown here.



Designed especially for extremely large machine tool way grinding is this typical Thompson Hydrail Way Grinder. Size 48" x 48" x 192". Part: grinder bed ways.



One of several new Thompson Double Head Dovetail Way Grinders installed to speed work and hold accuracy in the plant of a leading lathe manufacturer.



Multi-wheel grinding with auxiliary vertical head. Equipped with horizontal spindle having dual spaced wheels and auxiliary inclinable spindle. The front contoured grinding wheel grinds the rear set of ways and the rear grinding wheel grinds the front set, with vertical head grinding the sides and undersurface of the ways and rack seat.

Write for details Today.

The Thompson Grinder Company, Springfield, Ohio

Thompson SURFACE Grinders

Copyright 1952—The Thompson Grinder Co.

Adaptable

1 NATCO TWO-WAY DRILLER made up of two HOLEUNITS

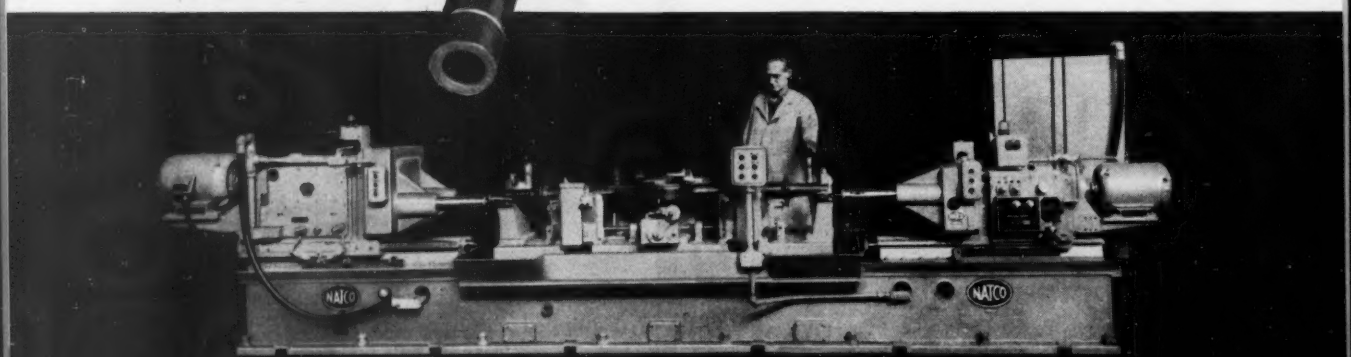
R. H. HEAD Drill one hole for tapered hole (approximately 1/32" smaller than small end of taper)

L. H. HEAD Drill one hole for tapered hole (approximately 1/32" smaller than small end of taper)

L. H. HEAD Drill one hole with multi-diameter tool to remove as much stock for taper as possible.

PART: Axle Housing

PRODUCTION: 30 parts per hour



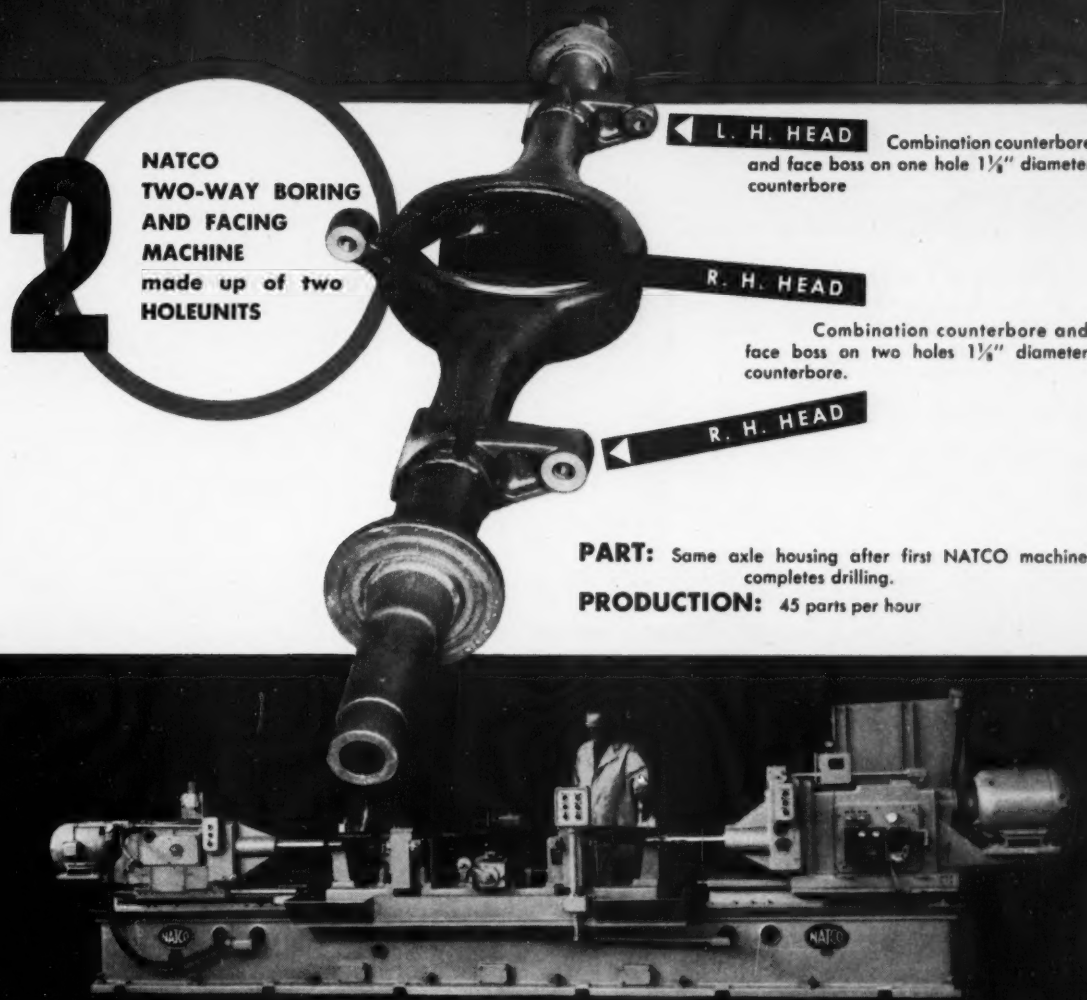
NATCO ENGINEERED for Quality and Quantity Production

NATCO HOLEUNITS ARE FLEXIBLE AND INTERCHANGEABLE . . . They provide standard, compact, self contained hydraulic units which can be arranged in groups to drill, bore, ream, counterbore, hollow-mill, chamfer, face or tap in various sides of a part with a minimum of handling. NATCO HOLEUNITS will operate horizontally or at any angle to form a way type or station type machine. Should the part or parts be altered NATCO HOLEUNITS may be re-arranged with new spindle boxes. Thus you get highly specialized machines with standardized NATCO HOLEUNITS for highest production at low cost. Let a NATCO Field Engineer solve your "hole" problem.

NATCO HOLEUNITS

TEAMED-UP FOR ECONOMICAL PRODUCTION

2 NATCO TWO-WAY BORING AND FACING MACHINE made up of two HOLEUNITS



L. H. HEAD — Combination counterbore and face boss on one hole 1⅛" diameter counterbore

R. H. HEAD — Combination counterbore and face boss on two holes 1⅛" diameter counterbore.

R. H. HEAD

PART: Same axle housing after first NATCO machine completes drilling.

PRODUCTION: 45 parts per hour

Call a Natco Field Engineer

to help you solve your problems in Drilling, Boring, Facing and Tapping.

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices

1809 Engineering Bldg., CHICAGO • 409 New Center Bldg., DETROIT
1807 Elmwood Ave., BUFFALO • 2902 Commerce Bldg., NEW YORK CITY

ACCURACY is

Micrometer accuracy starts with Cincinnati Hydraulic Holddowns. They exert tons of pressure and automatically hold all thicknesses of work securely.

necessary

...AND THE SPEED AND VERSATILITY OF

CINCINNATI SHEARS

IS NEEDED, TOO...

Here at The W. J. Holliday Company, Inc., The Department Store of Steel—these busy Cincinnati Shears operating continuously, shear accurate blanks to customer size.

They handle cold finished, or pickled and oiled sheets up to 10 gauge and hot rolled sheets up to ¼". Both management and operators are enthusiastic about their Cincinnati Shears.

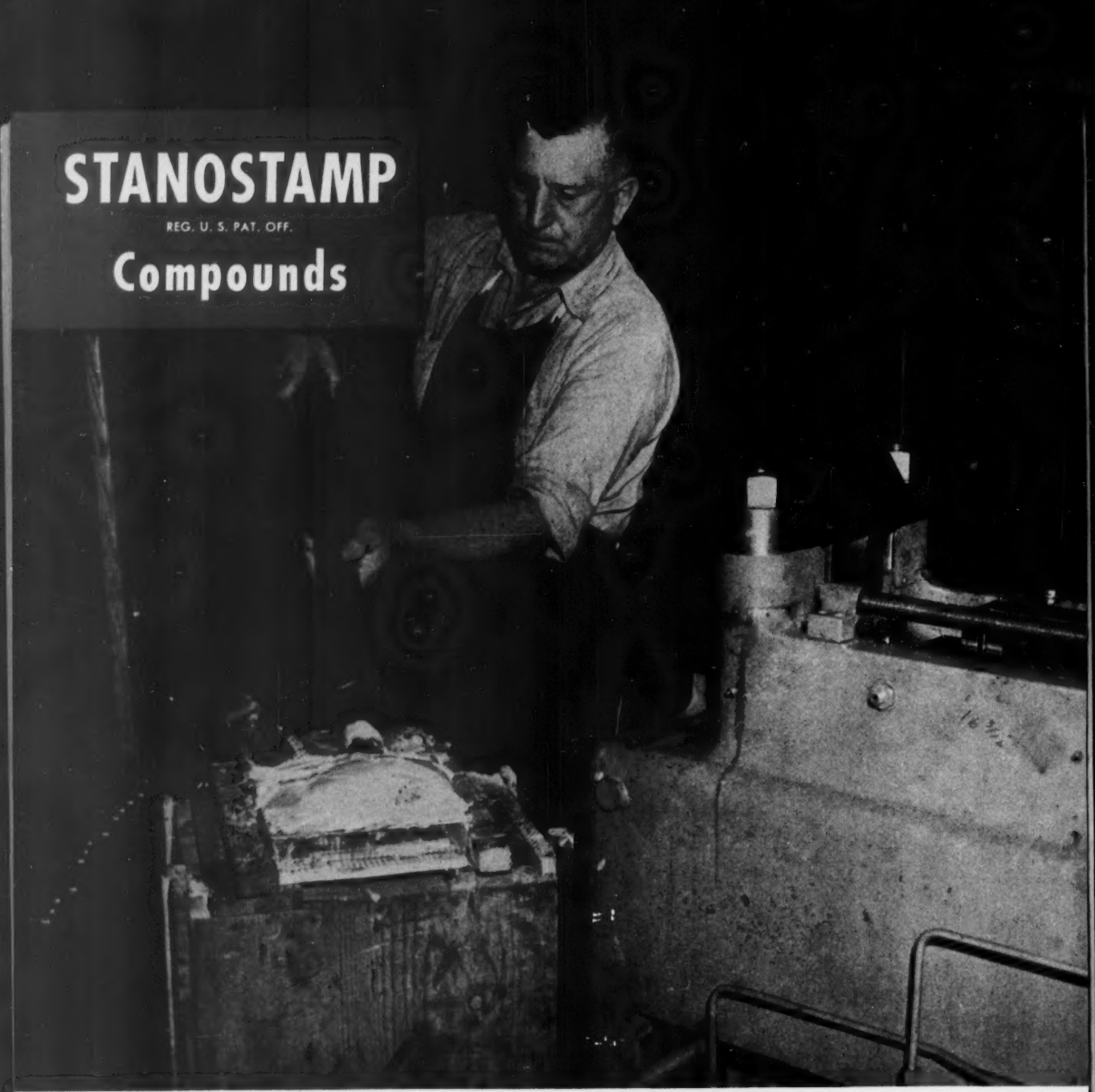
Write for Shear Catalog S-6.

Photos courtesy The W. J. Holliday Company, Inc., Indianapolis, Indiana

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. **SHAPERS • SHEARS • BRAKES**

CINCINNATI



Easy on the draw

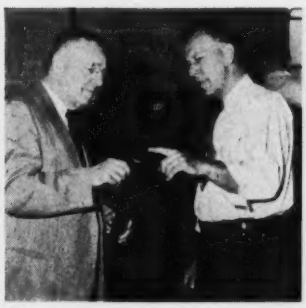
● Shown above is the drawing operation used by The Lock Joint Tube Co. in the production of automobile steering gear jackets. Two ¼-inch draws are made on steel tubing.

Dissatisfied with the performance of a conventional drawing compound on this job, operators took the advice of a Standard Oil lubrication specialist and switched to STANOSTAMP C Compound.

This product has met their needs on every count. It has proved economical to use because operators have been able to mix it with water and soluble oil and apply that mixture in light coatings to the steel tubing. STANOSTAMP C has provided better protection for dies, thus reducing wear. Draws are now made on over 2,000 pieces before dies require polishing. Although the drawn pieces are not cleaned until long after the drawing operation, there have been no rusting troubles.

Whatever your problem or need, you'll find, as did this midwest company, that a Standard Oil lubrication specialist can help you. He has a complete line of high quality cutting oils to offer and the training and practical experience to apply them most effectively. You can get his help quickly and easily by phoning your local Standard Oil Company (Indiana) office. Or write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

What's YOUR problem?



Russ Jenkins (left), lubrication specialist in Standard Oil's South Bend office, helped the superintendent of this midwest plant improve a drawing operation through the use of a STANOSTAMP Compound.

Mr. Jenkins is one of a corps of able lubrication specialists who are located in Standard offices throughout the Midwest. These men have been specially trained in Standard Oil Lubrication Engineering Schools and, in addition, have a wealth of on-the-job experience. The specialist nearest your plant is ready to give prompt, expert, and thorough attention to your lubrication problems.

It's easy to obtain his services. A phone call to your nearest Standard Oil Company office will bring him quickly to your plant . . . with no obligation to you, of course.

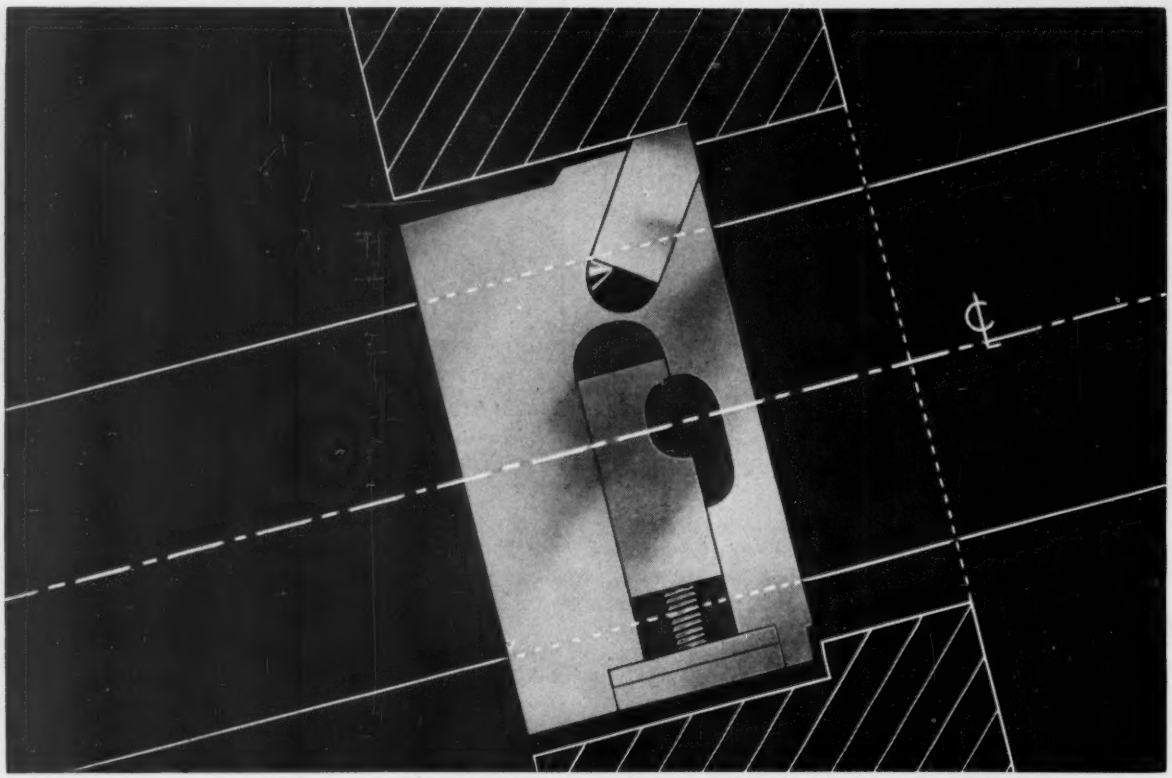
Spells "finish" for another cutting problem. A midwest manufacturer wanted better finish on steel valve seats. STANICUT Cutting Oil 117 BCS replaced a more expensive product on this screw machine job and produced the desired finish. It also extended tool life, resulting in lower tool cost and fewer tool changes.

Solution for a hard water problem. SUPERLA Soluble Oil has helped the U. S. Machine Corporation, Lebanon, Indiana, overcome a hard water problem. Mixed with the hard water used in the plant, SUPERLA Soluble Oil has given excellent results on jobs calling for the machining of cast iron. There has been no spoilage of the work due to rusting. Tool life has been highly satisfactory. Clean operation and freedom from odor development have provided desirable working conditions for machine operators.

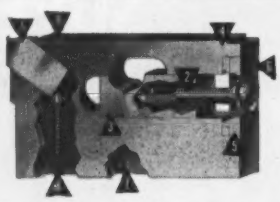
STANDARD

STANDARD OIL COMPANY
(INDIANA)

Get fast, positive line boring accuracy for 2½" to 17" dia. with...



DAVIS SINGLE CUTTER MICROMETER ADJUSTABLE BLOCKS



1. Cutter — Carried in stock of HSS or Tungsten Carbide tipped. Other materials per order.
2. Micrometer adjusting screw.
3. Gib—Hardened and precision ground to fit dovetail slot in block, allows for seating and accurately clamping of block with taper lock screw. The taper lock screw clamps the block firmly against the rear of the slot in the same manner as used in the Davis standard block type construction.
4. Keeper Plate — Retains adjusting screw.
5. Keeper Block — Retains adjusting screw.
6. Keeper Screws — Holds assembly in block.
7. Centers—For circle grinding cutter on diameter.
8. Cutter Support Screw — Supports and adjusts cutter for regrinding purposes.
9. Cutter Lock Screw—Locks cutter firmly in place.
10. Cover Plate — (Not Shown). Dovetailed to fit block prevents entrance of foreign matter into gib and screw assembly.

HERE'S the way to boost efficiency on general purpose jobs that demand rigidity and a wide range of cutter adjustments.

In addition to regular line boring with either standard or special bars, Davis tools with the exclusive adjustable feature are easily adapted to counterboring, undercutting, grooving, facing or chamfering. Block and cutter adjust as a unit to assure full cutter support at all settings.

Made of high grade tool steel, hardened and ground, the blocks can be furnished with High Speed Steel, Cobalt, Stellite, Tungsten Carbide tipped or Tantalum Carbide tipped cutters.

For details, write for bulletin No. 602.

If Davis can't bore it, it can't be done!

DAVIS BORING TOOL DIVISION

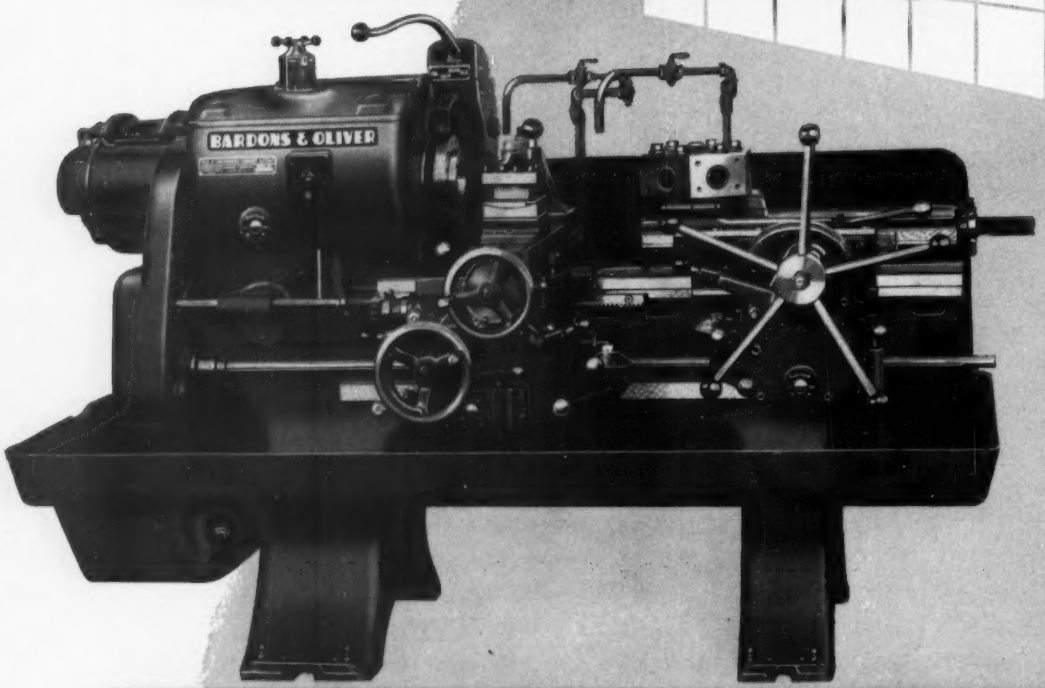
GIDDINGS AND LEWIS MACHINE TOOL COMPANY

FOND DU LAC, WISCONSIN

WHEN THE
GOING IS
TOUGH...
CLE-FORGE
HIGH SPEED DRILLS
will give you
more holes per grind...
Telephone Your Industrial Supply Distributor
CLEVELAND
DISTRIBUTORS EVERYWHERE
are ready to serve you!
THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58
E. P. Barrus, Ltd., London W. 3, England

Westinghouse

DOUBLES production on heater head flange



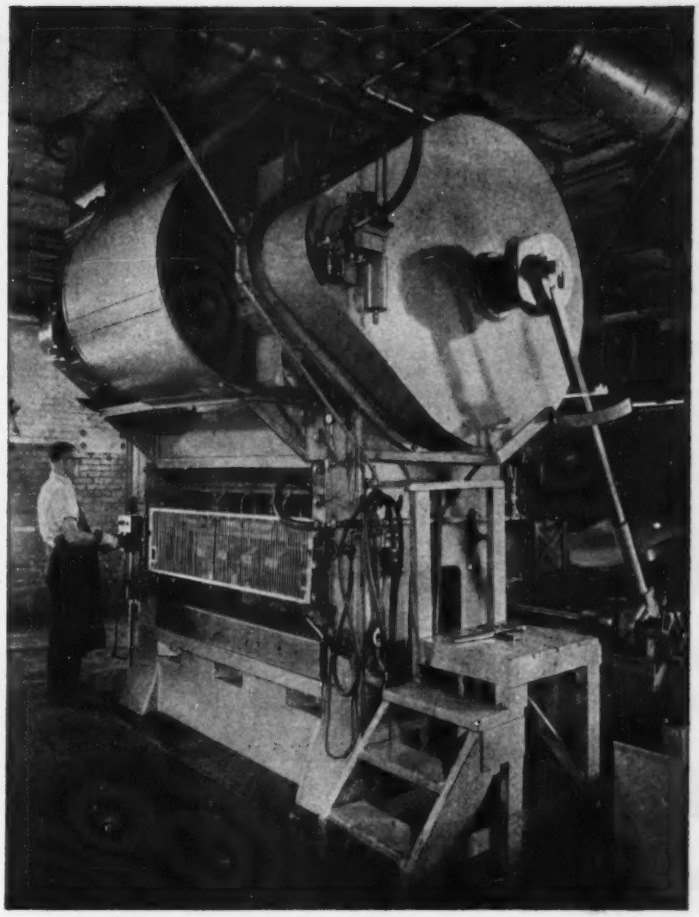
with BARDONS & OLIVER turret lathe

After Westinghouse installed the new Bardons & Oliver No. 5 Turret Lathe their production on Corox Heater Head Flanges increased over 100%.

The performance story at Westinghouse is just one of many. Bardons & Oliver Turret Lathes have served industry for over 60 years with continuing improvements to keep ahead of modern industry. Your inquiry for literature or additional information is always welcome.

BARDONS & OLIVER, INC.

1135 WEST 9TH STREET • CLEVELAND 13, OHIO



All main bearings and slideways protected by Minster's automatic oil lubrication system with return. The oil lubrication to the main bearings is under heavy pressure. Oil to the slideways and other bearings is supplied by the same system but is under gravity flow.

MINSTER PRESS CUTS 80,000 POUNDS OF STEEL DAILY FOR 6 YEARS WITHOUT A BEARING FAILURE

Complete, convenient protection to main bearings and slideways is a "must" with modern automatic production presses. You get that protection with Minster's automatic oil lubrication system, first installed on a Minster press in 1939.

Typical performance record is that of the press illustrated . . . 80,000 lbs. of steel cut up daily for six years without a single bearing failure.

Minster's automatic oil lubrication system creates a protective film on bearing and slideway surfaces having extremely close clearances. It proves the necessary frequency of lubrication as well as eliminates possible operator forgetfulness. It is a return system with central pump, two filters and reservoir.

Automatic oil lubrication with return is an important contribution pioneered by Minster. It is another example that proves the statement: Minster is first in press design.

MINSTER
FIRST IN Press DESIGN

THE MINSTER MACHINE COMPANY, MINSTER, OHIO

SQUEEZE PLAY

35 ton "Hy-Power" Riveter attaching brake backing plate assembly to rear axle housing with cold rivets.

. . . on riveting costs

Here's why manufacturers of autos, trucks, farm implements and other fabricated metal products use Hannifin "Hy-Power" Hydraulic Riveters: **"Hy-Power" formed rivets cost less . . .**

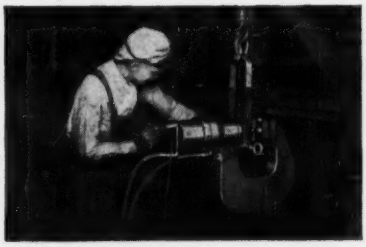
ONE MAN RIVETING. No bucker-up needed. Hannifin light weight, forged C-frames are easily maneuvered and positioned by one man.

FASTER RIVETING. Even unskilled operators head ⅜″ rivets in 2½ seconds. A single control button starts and stops the automatic cycle.

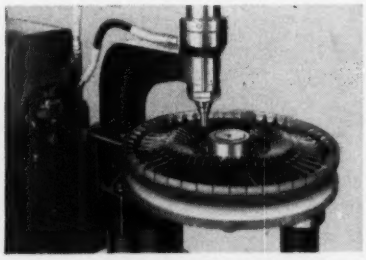
STRONGER JOINTS. This "silent squeeze" method, hot or cold, expands rivets to fill holes completely; forms fillets under both heads for extra strength.

SELF-CONTAINED, QUIET. The Hannifin "Hy-Power" Hydraulic Pressure Generator quietly supplies pressure to the "Hy-Power" cylinder which does the work. These cylinders are available in 7½, 10, 12½, 17½, 25, 35, 50, 75 and 100-ton capacities.

OTHER OPERATIONS, TOO. In addition to riveting, Hannifin "Hy-Power" equipment is used for staking, punching, forming, pressing and bending. Write for your copy of Bulletin 150.



One man handles this 50-ton "Hy-Power" Riveter with effortless ease in working on railroad car underframes.



A stationary "Hy-Power" Riveter joins hub and runner assembly of hydraulic couplings.

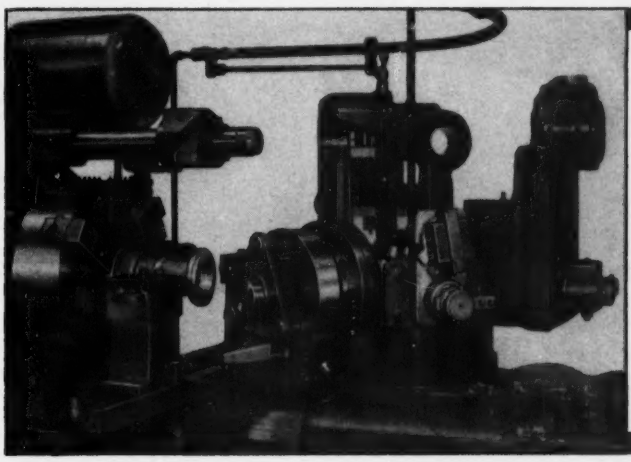
HANNIFIN

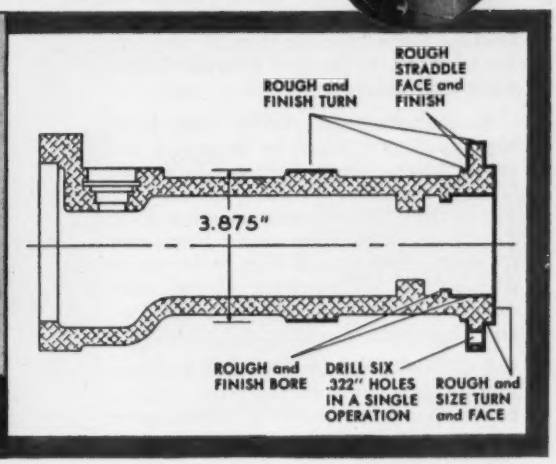
Hannifin Corporation, 1109 S. Kilbourn Ave., Chicago 24, Illinois

Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves

Not Just a Hole in One— but 6 IN ONE... *SIMULTANEOUSLY!*

CAST ALUMINUM HOUSING



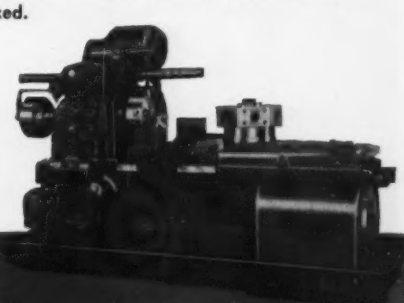

ROUGH and FINISH TURN
ROUGH STRADDLE FACE and FINISH
3.875"
ROUGH and FINISH BORE
DRILL SIX .322" HOLES IN A SINGLE OPERATION
ROUGH and SIZE TURN and FACE

SURFACES MACHINED ARE INDICATED BY HEAVY LINES

On a 5-DE POWER-FLEX Automatic Turret Lathe teamed with P&J TOOLING

An unusual job? No, not for that great production team, a P&J Automatic *plus* P&J Tooling, that has taken hundreds of other tough jobs like this in its stride . . . and done them faster, better and more profitably. The ingenious, time-saving set-up shown here makes use of a slide tool — operated by the cam on the overhead pilot bar — to machine the two 3.875" diameters which are smaller than the flange diameter nearest the turret. Notice too that all six holes in the flange are accurately located and drilled simultaneously in a single operation. This is made possible by using a special P&J Multiple Spindle Drill Head that is automatically indexed into position and locked.

If you'd like to produce your hard-to-machine jobs quicker and more accurately with fewer rejects and greater profits, let the P&J Team go to bat for you. **Send today for your copy of the 5D POWERFLEX Bulletin No. 131 . . . or ask P&J Tool Engineers to submit recommendations based on your own prints or sample parts.**



POTTER & JOHNSTON Co.
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
PRATT & WHITNEY
DIVISION NILES – BEMENT – POND COMPANY

WRITE DIRECT OR CONTACT YOUR NEAREST PRATT & WHITNEY BRANCH OFFICE
BIRMINGHAM • BOSTON • CHICAGO
CINCINNATI • CLEVELAND • DETROIT
LOS ANGELES • NEW YORK • PHILADELPHIA
PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., PAWTUCKET, R. I.
AGENTS: DALLAS, THE STANCO CO., HOUSTON, WESSENDORFF, NIELMS & CO.

Parts cleaning time slashed 80 per cent

Bearings cleaned faster, more thoroughly, by G-E Ultrasonic Generator

Miniature Precision Bearings, Inc., of Keene, New Hampshire, manufacturers of precision ball bearings in miniature sizes, has reduced cleaning time of ball-bearing parts by more than 80 per cent by adopting a General Electric Ultrasonic Generator.

In manufacturing these small bearings, each part must be measured and tested many times during fabrication. This manufacturer formerly used forced-air cleaning and time-consuming hand dipping to clean components. Now, with ultrasonic irradiation, fifty parts can be cleaned by one operator in less than one minute to meet rigid inspection—cutting rejects of assembled bearings.

G-E ULTRASONIC GENERATOR has been found increasingly effective for cleaning of small parts; cleans in inaccessible corners, small holes, and wherever complicated shapes exist; speeds cleaning in a 10-to-1 or even 100-to-1 ratio.

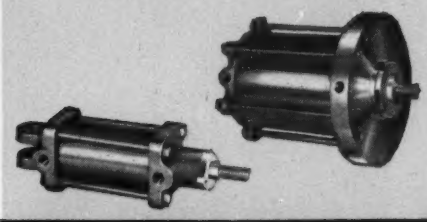
Your nearest G-E Apparatus Sales Office will furnish further information on ultrasonic cleaning, or send your specifications to General Electric Co., Section 687-128, Schenectady 5, N. Y. Send for your free copy of Bulletin GEA-5669 on ultrasonic cleaning.

50 PRECISION PARTS can be placed in the beaker and cleaned in less than one minute with ultrasonics. Cleaning can be done with either alkaline or hydrocarbon solvents.

EASY OPERATION of ultrasonic generator eliminates cleaning bearings with cumbersome baths, and cuts handling time. Other users report ultrasonic cleaning easily removes waxes, oils, greases, and even residual metal chips.

You can put your confidence in—

GENERAL ELECTRIC



Pneumatic Cylinders

Really complete, the Hannifin line of pneumatic cylinders is made with two types of pistons . . . bores from 1" to 16" . . . six standard mountings. Really standard, these cylinders are tooled to tolerances that assure accurate mounting to make assembly to your machines easier. Really built, each cylinder is "TRU-BORED" and honed, piston rods are ground and polished, interchangeable end caps, heavy duty tie rods . . . rugged, yet precision construction throughout!

Write for Bulletin 210

NOW...

HANNIFIN HAS THE MOST COMPLETE LINE OF AIR CONTROL EQUIPMENT!

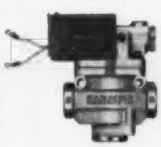
NEW! REVOLUTIONARY HANNIFIN *P-M Pilot-Master Valves*

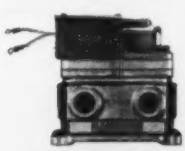
Piston-operated poppet design. Exclusive replaceable cartridge for easier maintenance. Speeds to 600 cycles per minute. Pressure from 15 to 150 p.s.i. Integral, solenoid-controlled pilot heads or a choice of 10 separate pilot valves for remote control.

- Fewer Valves to Stock
- Fewer Parts to Stock
- Maximum Interchangeability
- No Springs in Main Valve

Write for Bulletin 231.

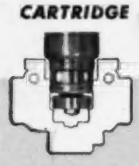
2 and 3-Way Valves.
Same valve operates 2-way or 3-way, normally open or normally closed. ⅜" to 1¼" I.P.S.



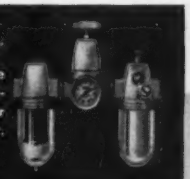


4-Way Valves.
Two 3-way valves mounted in compact, common body. Two piston poppets. Two cartridges. ⅜", ½", ¾" I.P.S.

EXCLUSIVE REPLACEABLE CARTRIDGE



AIR WARDEN
Air filters, pressure regulators and lubricators to protect air operated equipment. Bulletin 10108.



Disc Type Air Control Valves

Designed for smooth, positive and accurate control of air-operated equipment. Bronze discs lapped to perfect seal with seats. Packless design. For hand, foot or electrical operation. Sizes: ⅛" to 1¼" I.P.S.

Write for Bulletin 57-W

Hannifin "Directair" electrically controlled air-operated disc valve

Foot-operated treadle valve (Also spring return and rotary types)

Standard hand control valve (Single or duplex)

HANNIFIN

Hannifin Corporation, 1109 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

IF IT'S

P-K®

IT'S OK

OK for Hardness and Toughness

OK for Tensile Strength

OK for Shear Strength

OK for Thread Contour and Lead

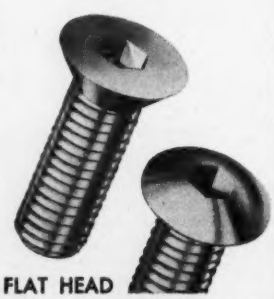
Good judgment calls for

PARKER-KALON

when good design calls for

SOCKET SCREWS

SIZE-MARKED CAP



FLAT HEAD

BUTTON HEAD

GROUND THREAD SET

ORDER from the local P-K DISTRIBUTOR... the SUPPLY SPECIALIST that serves you

This unique head design saves assembly time

Only P-K offers the Size-Mark and Gear Grip on Socket Head Cap Screws.

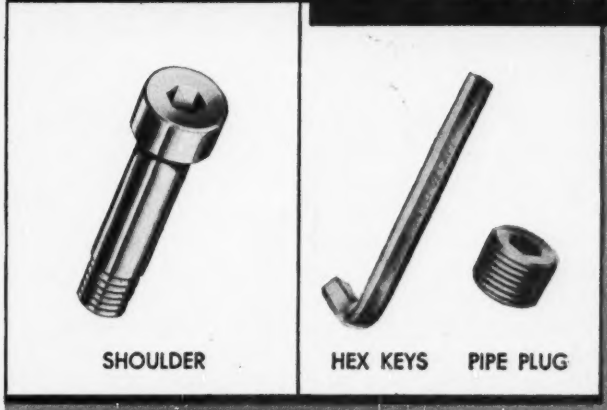
The size is clearly incised on the head, can be seen at a glance. It saves time and wasted screws when sizes get mixed up, prevents errors by "green" workers, helps veterans, also, to speed assembly. Maintenance men like it — it aids them in reassembling. Gear Grip prevents slips, speeds work, even when fingers are oily.

Since assembly expense is a sizable percentage of total production costs (in some products as high as 75%), fastening operations are any manufacturer's primary target for cost reduction.

Start making savings you've missed. Ask for samples. Parker-Kalon Corporation, 202 Varick St., New York 14.

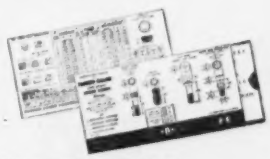
PARKER-KALON®

SOCKET SCREWS



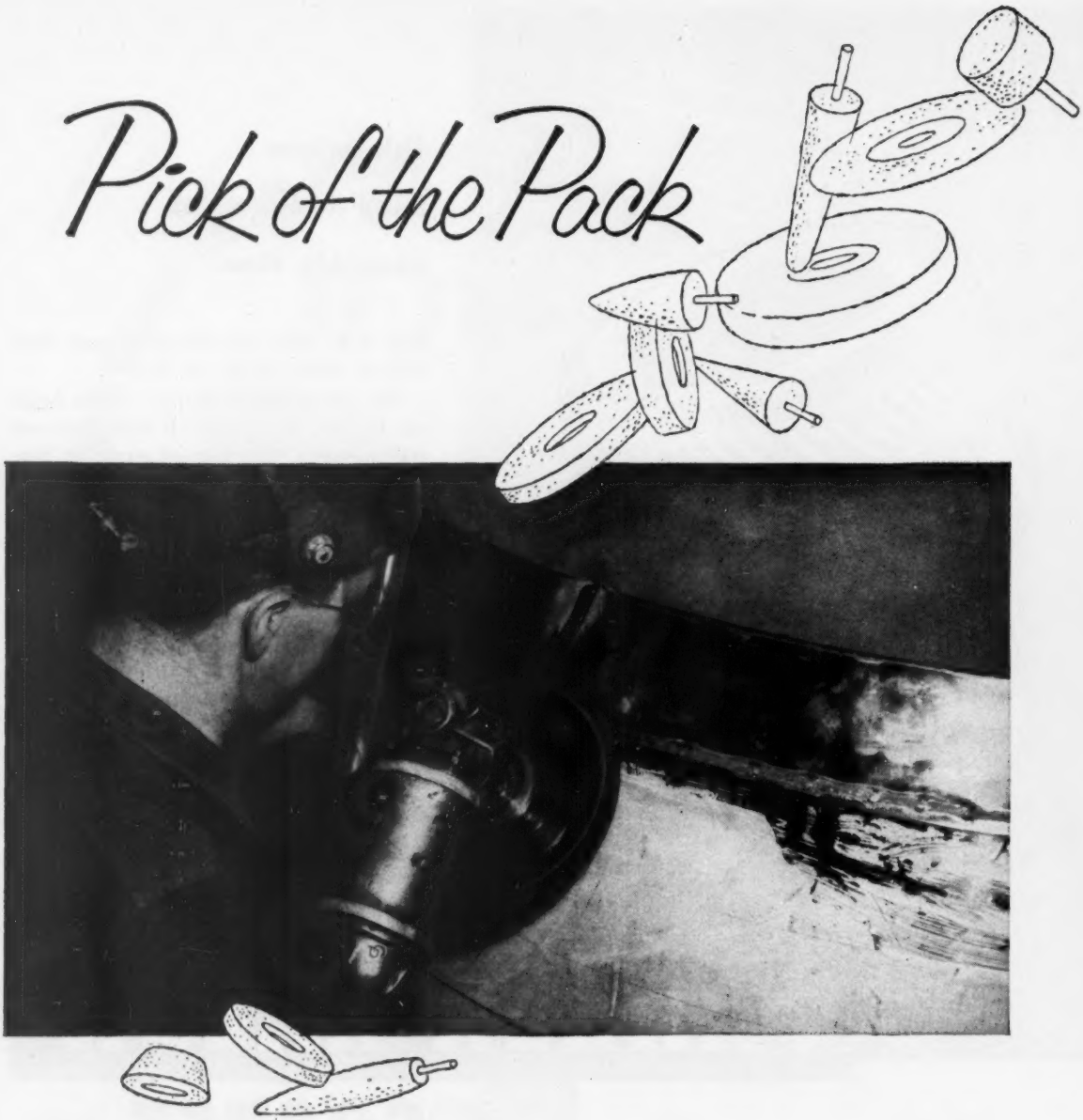
OK for Trouble-free Assemblies

SOCKET SCREW DIMENSION FINDER



Helps you plan assemblies. Pocket-size plastic chart gives essential dimensions of all types of P-K Socket Screws. Includes Set Screw Point Dimensions, and Thread Length Formula. Available FREE from your P-K Distributor.

Pick of the Pack



Production men give varying degrees of importance to one tool feature over another . . . lightweight . . . high speed . . . ease of handling and low power consumption or low maintenance. But they always agree that the all-important requirement is *the ability of the tool to increase man hour productivity.*

And that's where CP Hicycle Portable Electric Tools for grinding, sanding, buffing and polishing can help out. CP Hicycle tools not only increase work productivity but they answer all other requirements, too! They're lightweight and easy to handle with no speed sag under load. Their Hicycle induction motor assures maximum power with low maintenance – has solid rotor, no armature to burn out . . . no commutators or brushes to replace. Write for more details. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

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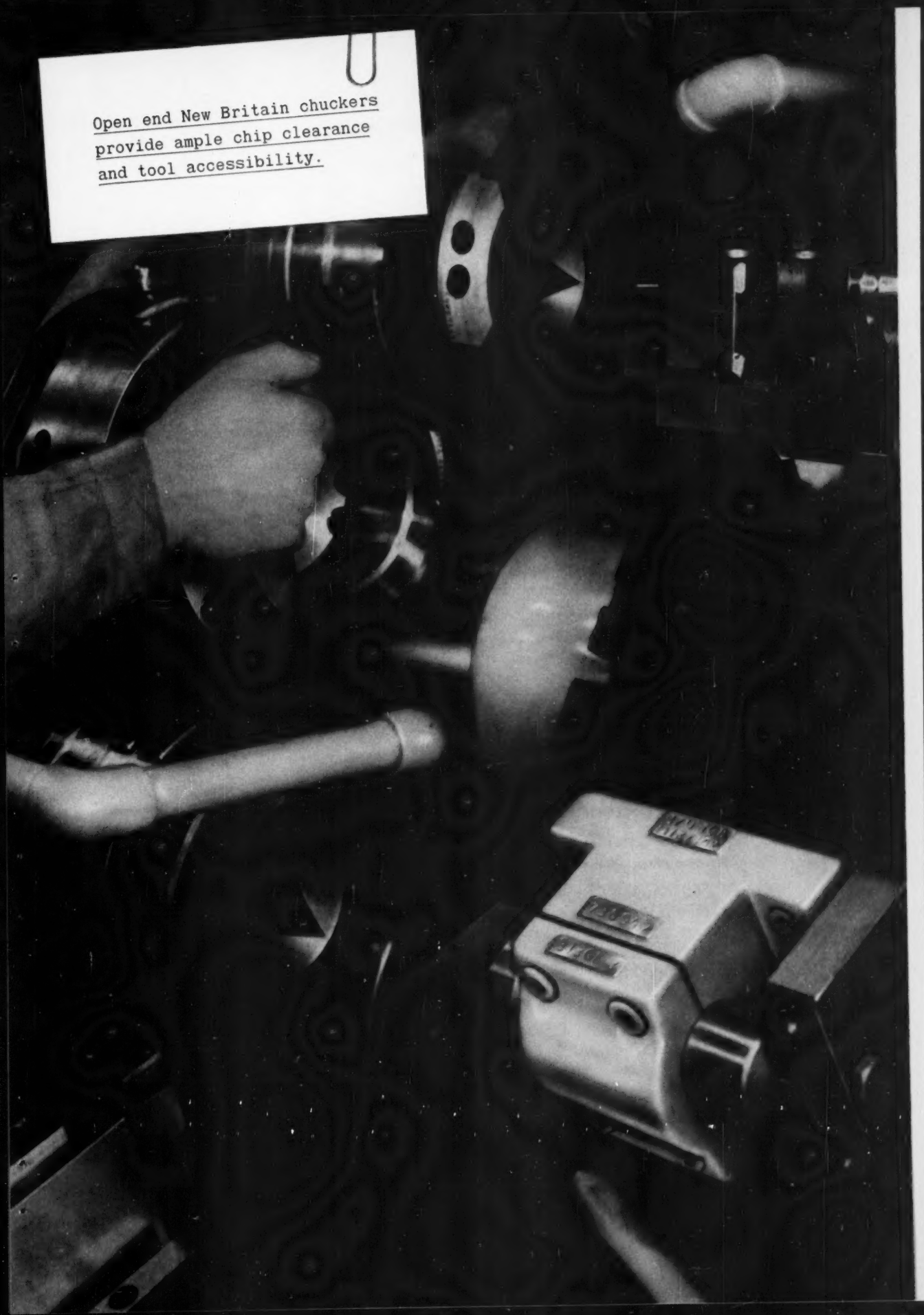
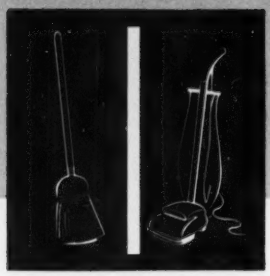


Open end New Britain chuckers provide ample chip clearance and tool accessibility.

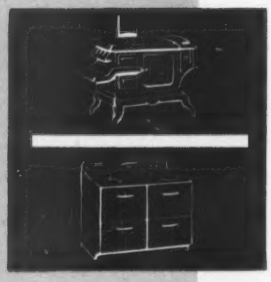


Machines for Making Progress

Try and find a manufactured product that hasn't been made better looking and easier to use than the similar product of even a few years ago.

The most amazing thing about these manufactured goods of today is that they cost the user relatively little more, or no more than they did when manufacturing costs were half what they are today.

The answer is not hard to find if you look inside the factories of leading manufacturers . . . more and more new and better automatic machines, making the most of new materials, and each performing more and more operations with greater speed.



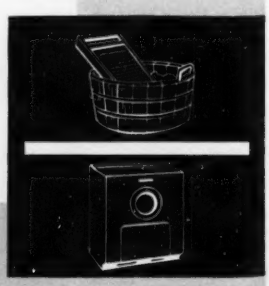
Machines for making progress are the tools for keeping the American economy at record breaking levels of prosperity. Many of these tools are New Britains. Illustrated are three which have provided cost cutting answers to literally thousands of manufacturing problems. Are you using them for all they are worth? Your competition is.

AUTOMATIC BAR AND CHUCKING MACHINES
PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING & MILLING MACHINES
NEW BRITAIN +GF+ COPYING LATHES

THE
NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division
New Britain, Connecticut

Lucas Machine Division
Cleveland 8, Ohio



Model

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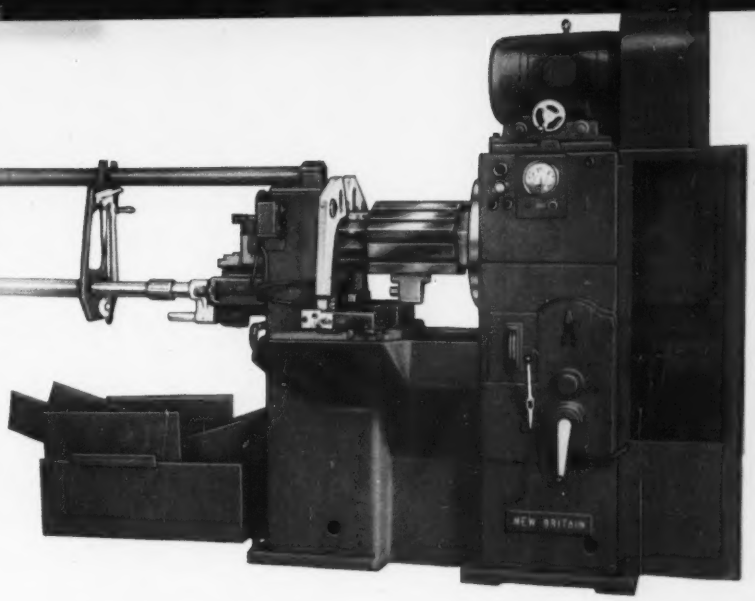
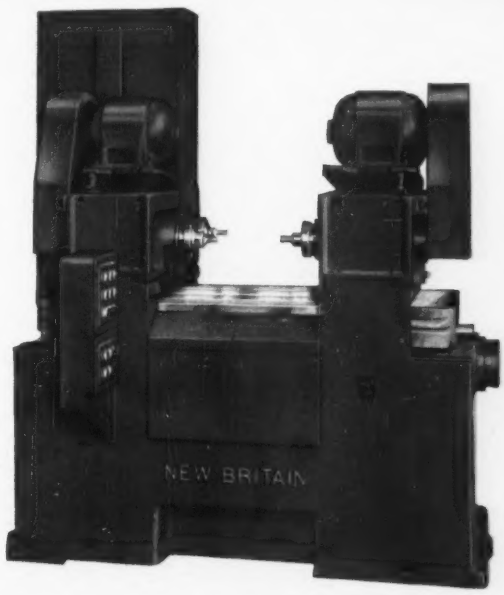
Model 126

A new New Britain single spindle automatic which belongs in almost every turret lathe department – to cut costs on pieces which are on the border line between turret lathe and multiple spindle production. It is remarkable for its mechanical simplicity and simplicity of operation. A new approach in single spindle turning, it incorporates important features which *guarantee* the quick set up essential to economical production and manpower savings, on both short and long runs.



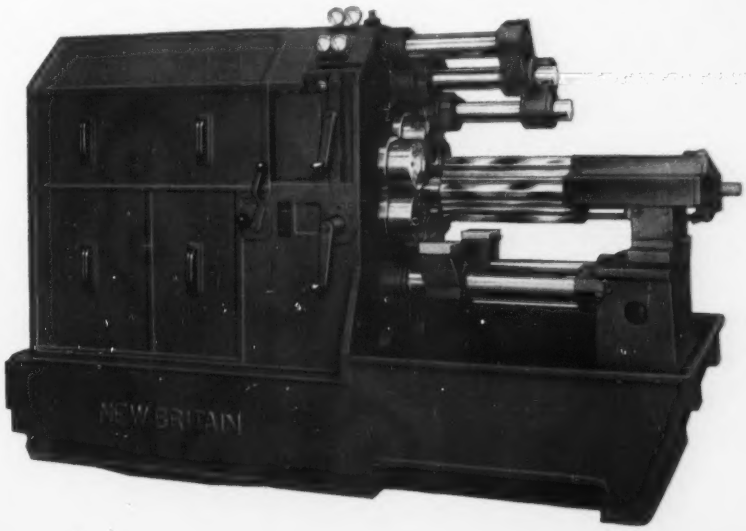
Model 50

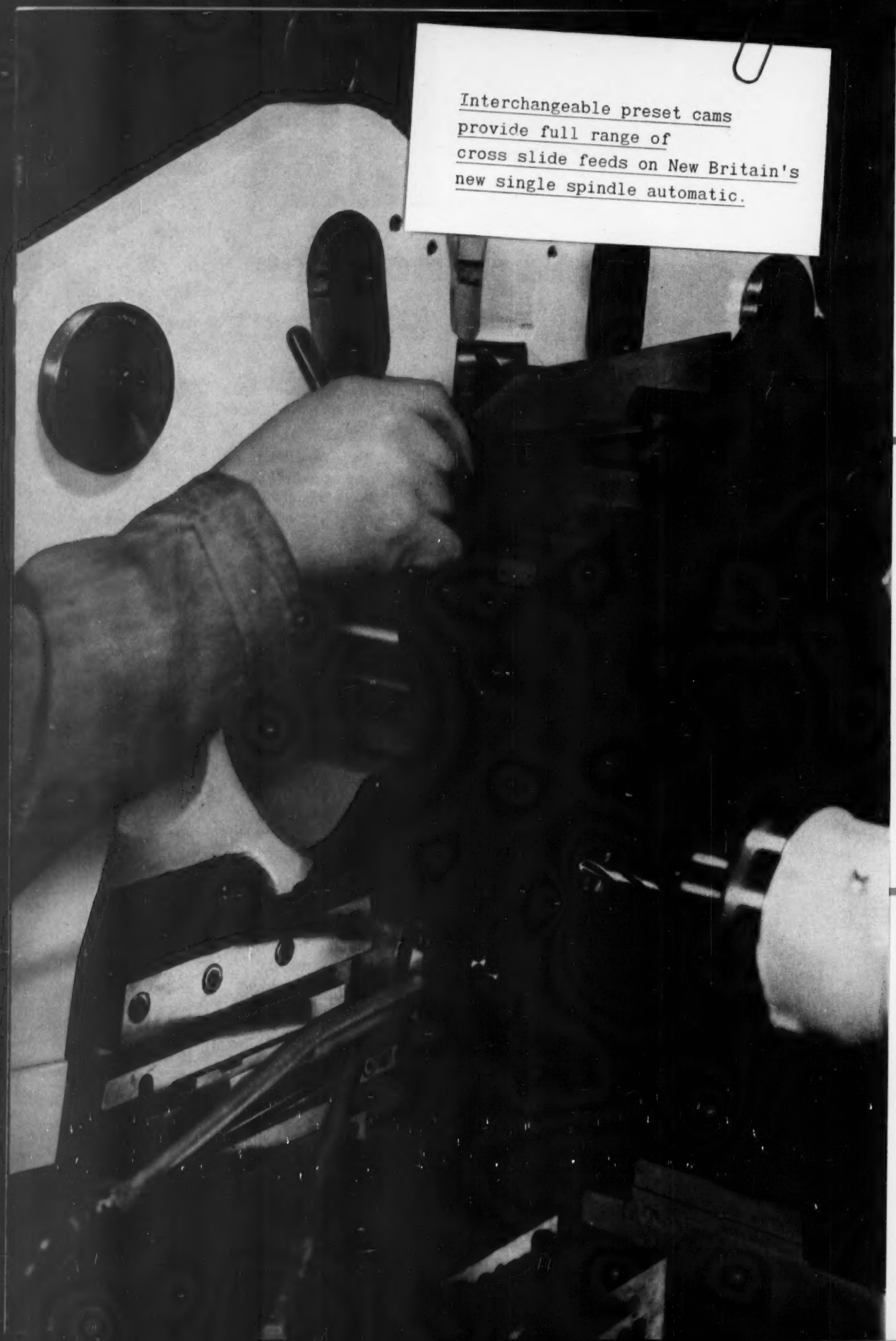
The New Britain double end, tool or work rotating precision boring machine specifically designed for products requiring the most exacting accuracy at high production rates. Tooling set ups and types of pieces machined are practically unlimited. Both double end and single end jobs can be profitably produced on this machine by the use of its automatic cycling features.



Model 675

Six spindle automatic chucking machine. This famous line of New Britain Automatics includes four, six and eight spindle machines, all notable for maximum rigidity, accessibility and permanent accuracy. Open end construction makes tooling, loading, operating adjustments and chip removal simple and easy, reducing down time to a minimum. This, combined with ample power and high spindle speeds, makes New Britain Chuckers outstanding for sustained high production.

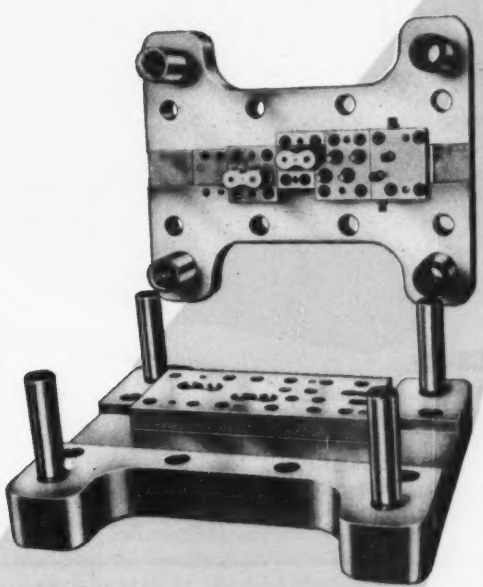




Interchangeable preset cams provide full range of cross slide feeds on New Britain's new single spindle automatic.

WHITNEY CHAIN

links up with... PRODUCTO DIE SETS



MATERIAL

¼" SAE 3140 hot rolled steel in coiled stock.

OPERATIONS

Station No. 1 — Whitney Chain markings clearly embossed on each link.

Station No. 2 — Four holes, two to a link, rough pierced.

Station No. 3 — Two chain links blanked out on each press stroke.

TOLERANCES

Hole diameter + .0005" — .0005"
Hole centers + .001" — .001"
Link Contour + .005" — .010"
Die Set face parallel to feed slot + .002" — .002"

PRODUCTION RATE

153,000 links blanked per 40 hour week.
Between grinds, 75,000 pieces.

NEED PROMPT SERVICE?
CALL YOUR NEAREST
PRODUCTO ASSEMBLY BRANCH

Tough, ¼ inch-thick hot rolled steel chain links are not an easy stamping job . . . especially when heavy production must be matched with close tolerances and excellent finish.

Here are the figures as this job rolls along at Whitney Chain on Niagara presses equipped with PRODUCTO 4-pin progressive die sets. It's typical of the way Producto Service teams up to set production records.

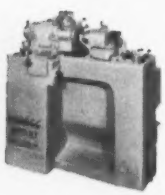
THE PRODUCTO MACHINE COMPANY
985 Housatonic Ave., Bridgeport 1, Connecticut
3PD52A

For Precision Die Sets *Fast* Call . . .

PRODUCTO

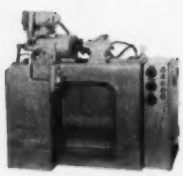
ALSO MAKERS OF TOOL AND DIEMAKERS ACCESSORIES, VISES, MACHINERY

bryant
internal grinding



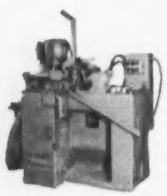
no. 1309-W

Finishes 2 bores and a taper straight and concentric. 2 wheelheads are used on this semi-automatic. Max. traverse stroke, 6". Max. grinding length, 3½".



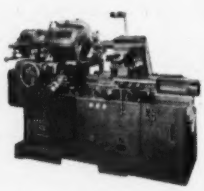
no. 1109

For high production of small bores where accuracy of size and finish are required. Max. traverse stroke, 6". Max. grinding length, 3½".



no. 2209

For precision and high production grinding of ball bearing races, gears, rolls, bushings, etc. Max. traverse stroke, 6". Max. grinding length, ¾".

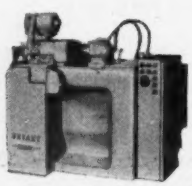


no. 1116

A general purpose hole grinder for tool room, small shop, or general production. Maximum traverse stroke, 20". Maximum grinding length, 8".

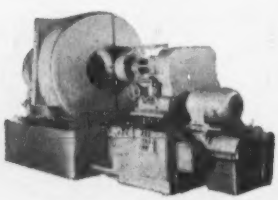
no. 1416

Specially designed for grinding bores in long work, such as machine tool spindles. Maximum traverse stroke, 20". Maximum grinding length, 8".



no. 1209

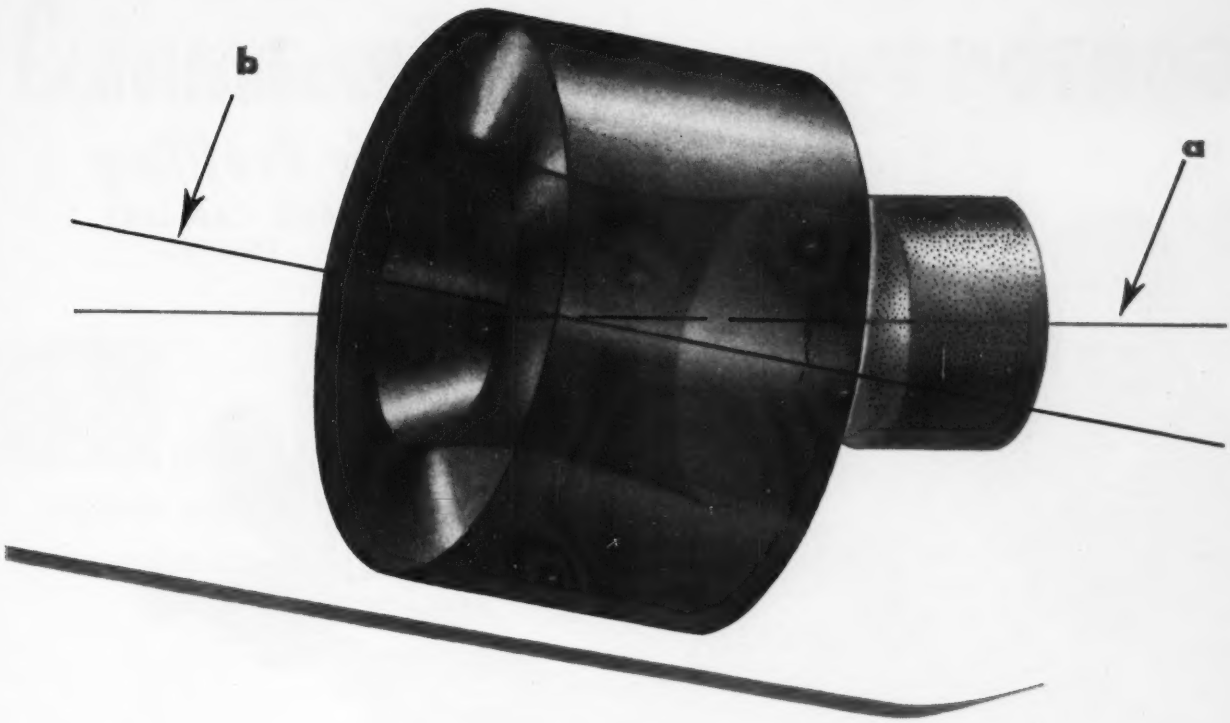
A fully automatic, high production machine for small and medium bore grinding. Max. traverse stroke, 6". Max. grinding length, 3".



no. 1460

For production or single piece hole grinding on parts up to 60" diameter. Max. traverse stroke, 21". Max. grinding length, 16".

"Alignment for Better Internal Grinding", a new, sound color moving picture is available for free showing to engineering groups. Write for descriptive booking form.



BELL mouth holes are a common internal grinding error. General available information advises simply turning the workhead or changing the length of traverse to correct this error, to generate a straight hole. In the case illustrated above, where bell mouth exists on both ends of the hole, either turning the workhead or changing the length of stroke will improve the shape of the hole but will not correct the error. In the illustration, the work axis "b" is tipped out of alignment with wheel and wheel path axis "a". When the wheel, moving on axis "a", traverses the front of the hole, it grinds above the work center line and the front of the hole will be oversize. As the wheel traverses the center of the hole, the hole will be smaller. As the wheel traverses the back of the hole, it grinds below the center line and the hole will again be oversize. While the wheel contact may be a full line, it will not be parallel to the axis of the work.

The only possible remedy is to correct the alignment of the workhead axis "b" so that it will be parallel with the wheel and wheel path axis "a". Wheel wear will be uniform but, most important, the geometry of the hole will be correct.

Bryant internal grinders are engineered to permit adjustment which will bring the workhead into proper alignment.

Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.

Internal grinders • Internal & External thread gages

GORTON *Brings You* High Production *Automatic Profiling of CAMS* AND CAM-LIKE SHAPES

Gorton Contour Mill, CM-12, Produces Extreme Accuracy and High-Surface Finish with Minimum Maintenance

This machine produces highly accurate, identical pieces — complicated cam shapes, external or internal, or continuous grooves and slots of irregular radii. The Gorton Contour Mill is easy to use and versatile — a simple tracer-controlled, vertical-head milling machine with two rotary power-driven tables. No complicated electronic, hydraulic or pneumatic controls.

CAPACITY . . .

Wide spindle-speed range — 300 rpm to 10,000 rpm — for either high-speed steel or carbide cutters, burrs or grit grinding wheels. The 16-inch master-copy table easily accommodates larger master cams. Several thin cams can be stacked and profiled at once.

EXTREME ACCURACY . . .

Operation depends upon a heavy, single-pivot beam which provides more accuracy than can be built into the tooling. A choice of several reduction ratios adds to accuracy and provides low micro-inch finishes. The reduction ratio principle produces piece parts to closer tolerances than those of the master.

CUSTOM-DESIGNED . . .

The basic machine is standard, but each mill is tooled for specific work. Because all machine elements are individually motor-driven, the machine can be adapted to a wide range of applications. Write for complete details and your copy of Special Bulletin 2380-C-1306.

GEORGE GORTON MACHINE CO.

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Cuts any metal that can be machined !

High speed steel shockproof segments curl the chips out of the cut for cooler, smoother, faster cutting, and longer sawing life.

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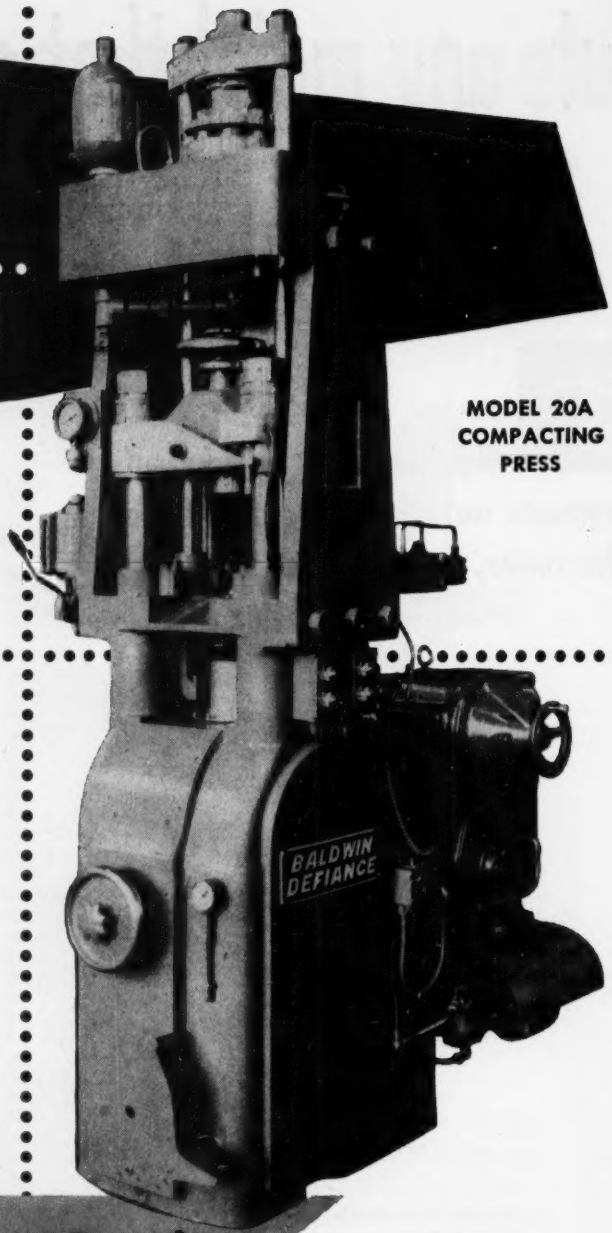
APPLIANCE PARTS COMPACTED TO UNIFORM DENSITIES... with a BALDWIN



MODEL 20A COMPACTING PRESS

THE PROBLEM:

One of the leading appliance manufacturers found it very hard to get parts of uniform density when compacting powdered metals.

THE BALDWIN SOLUTION:

By switching to Baldwin's Model 20-A, they are able now to compact parts of the desired uniformity. Specially designed for compacting powdered metals, this 75 ton press and Model 45-A (200 ton capacity) consistently produce compacts of even density for two reasons:

1. **The Balanced alignment** of the punch and die is assured by Baldwin's exclusive construction . . . the punch is mounted on a rigid four-column guided head, permitting no deviation from the direct up and down motion which maintains such constant pressures.

2. **The Efficient feeder** distributes the powder in the die more evenly because it is the reciprocating type that moves in and out over the die with a very smooth motion. Moreover, the feeder's cleanline design eliminates all recesses or projections that might keep the powder from filling the die cavity completely.

What's Your Pressing Problem?

For help in solving any of your compacting problems, you can count on the Baldwin Research and Development Laboratory. Please write for Bulletin 3100 to Dept. 4019, Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

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They wouldn't believe it either

—until they SAW it!

Seeing was believing for a group of mechanical officials from one of the mid-west's most prominent earth moving equipment builders.

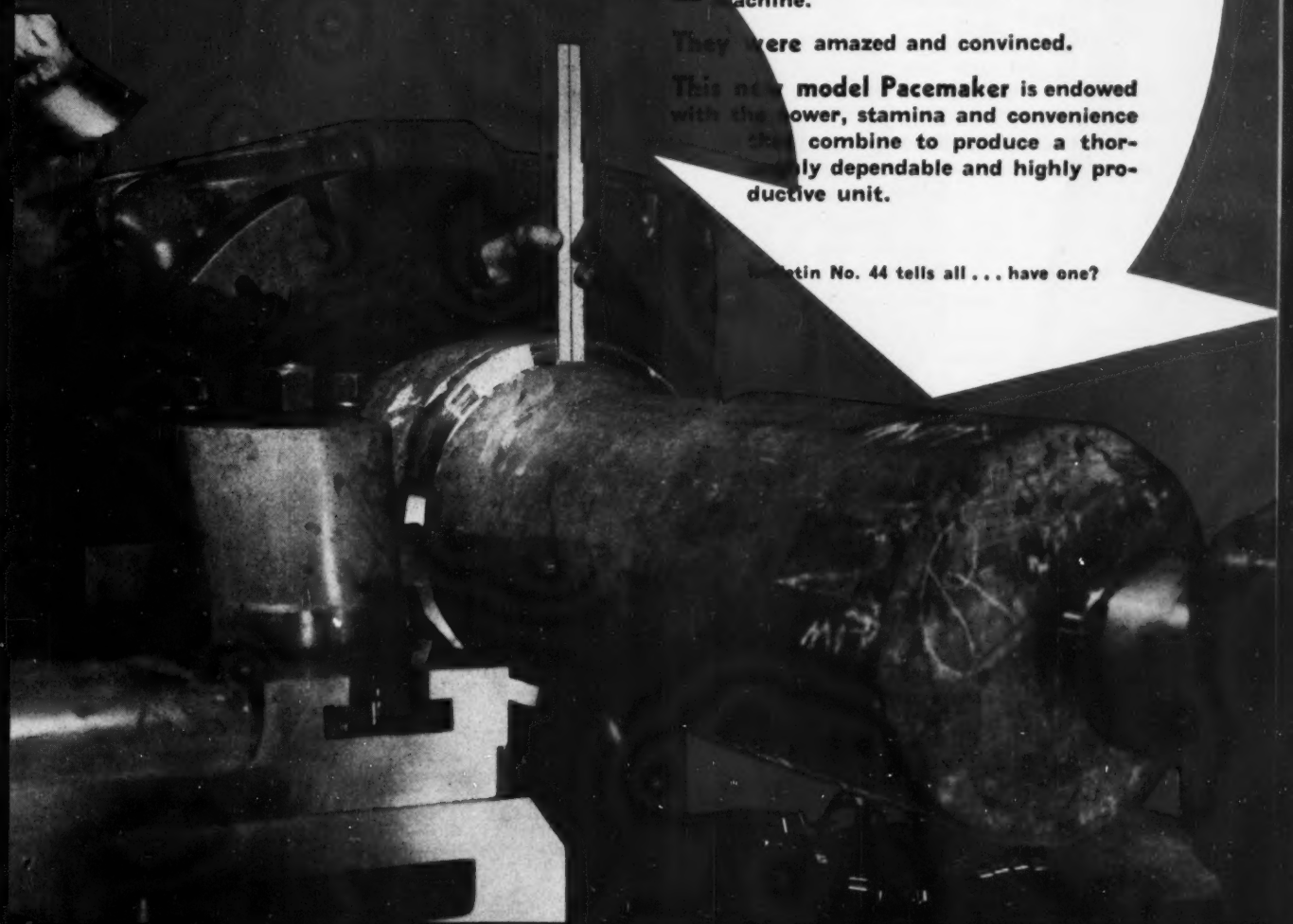
Frankly they just wouldn't believe that the new 32" "AMERICAN" Pacemaker Lathe would effectively use 60 horse power and cemented carbide cutting tools in machining rough and tough alloy steel forgings. So they came to see for themselves and they saw:

1. Cuts 1⅜" deep.
2. Cutting speed 300 feet per minute.
3. .030" feed.
4. 60 horse power registered by horse power meter during the maximum cuts.
5. Not a shimmy or whimper from the machine.

They were amazed and convinced.

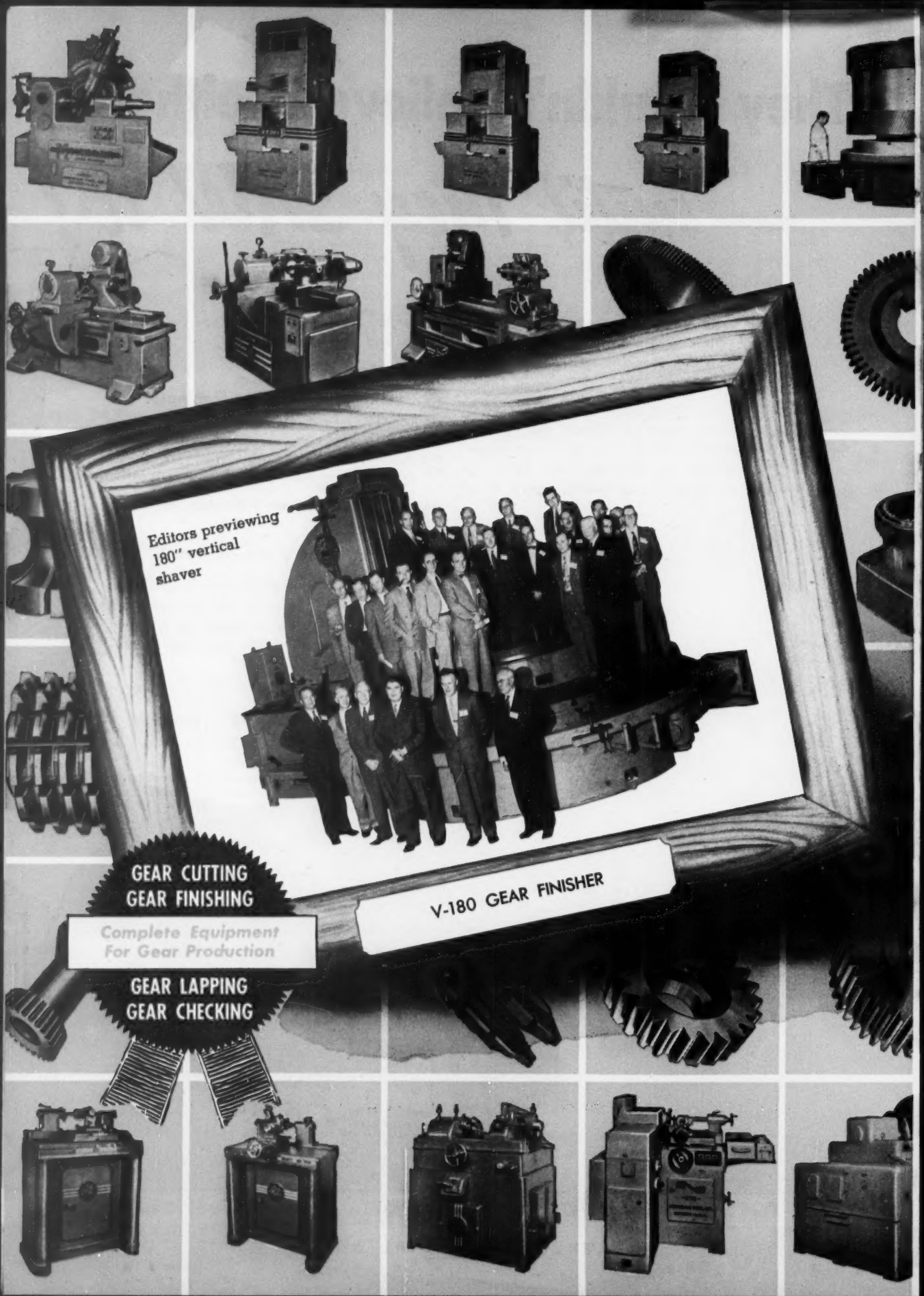
This new **model Pacemaker** is endowed with the power, stamina and convenience that combine to produce a thoroughly dependable and highly productive unit.

Bulletin No. 44 tells all . . . have one?



THE AMERICAN TOOL WORKS CO. Cincinnati, Ohio U.S.A.

LATHES AND RADIAL DRILLS


Editors previewing 180" vertical shaver
V-180 GEAR FINISHER
GEAR CUTTING
GEAR FINISHING
Complete Equipment For Gear Production
GEAR LAPPING
GEAR CHECKING

News....

for PRODUCERS of BIG GEARS

Large spur, helical, or herringbone gears with or without integral shafts, from 20 inches to 15 feet in diameter and up to 48 inch face width, as well as internal gears up to 48 inch diameter, 30 inch face width, can now be finished to high accuracy at far lower costs. Michigan's four new standard vertical shaving machines are designed for finishing large gears for marine, railroad, power plant, ordnance, and other applications. These V-series machines offer the following advantages:

1. **Drastic reduction if not complete elimination of costly and time-consuming lapping.**
2. **Great reduction in shaving time.**
3. **Ability to produce more accurate large gears than by any other process. (Accuracies down to three-tenths of a thousandth on 15-foot-gears.)**
4. **Ability to cut hobbing time by use of multiple thread hobs.**
5. **A standard machine (plus integral gear checking accessories) that provides high versatility in large gear manufacture.**

Large gears finished on Michigan Vertical Shavers are more accurate, have longer life and higher load carrying capacity. They operate more smoothly with a marked reduction in noise.

Write for Bulletin No. V-53

GEAR PRODUCTION HEADQUARTERS

MICHIGAN TOOL Company

Complete from blank to finished gear equipment

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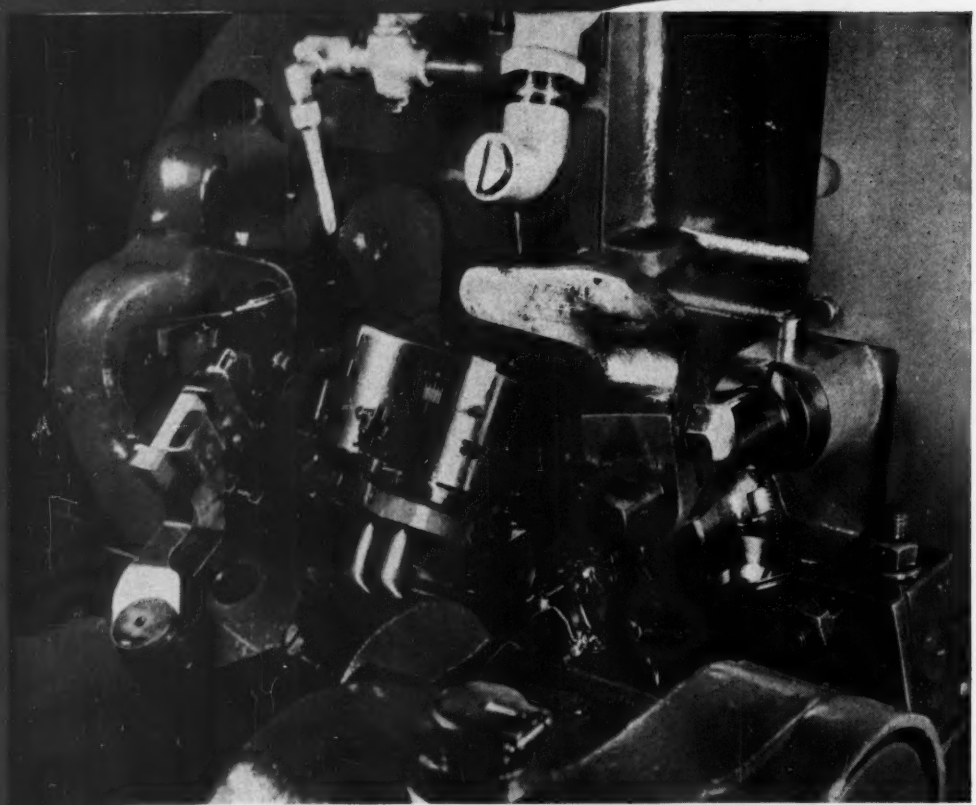
FIRST AID FOR FASTER MACHINING



ON ANY MACHINE, faster operation means greater production — and this is possible only with the right cutting fluid, properly applied. These conditions can be amply met with the aid of Texaco.

**There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to assure longer tool life, better finish, greater production—whatever the metal or your method of machining it.

**A Texaco Lubrication Engineer specializing in metal working will gladly help you choose the right cutting fluids for your jobs, help you in their proper handling and use.

Let Texaco help you do all your machining better, faster and at lower cost. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, GRINDING AND SOLUBLE OILS FOR FASTER MACHINING

By LORING F. OVERMAN

The Vance Plan or the Wilson Idea

KEYSTONE of United States economy and of its defense programs, machinery is a topic of continuing interest in Washington. Each new concept of how the defense program is to be handled requires a shift in thinking as it affects machinery.

The topic around which all conversation revolves is the expected compromise between the views expressed in the Vance Committee Report, and those voiced more recently by Defense Secretary Charles E. Wilson. The Vance Report recommended an extremely broad "mobilization base." The idea of the base was to establish stockpile productive capacity, rather than to produce and store planes, tanks, guns, and other military materiel subject to rapid obsolescence. Although it was conceded that plants become obsolete too, the Vance Committee contended that maintaining the broad "mobilization base" would cost much less than either junking obsolete fighting equipment or trying to win a war with it.

ONE trouble with the Vance conclusions, critics hold, was that estimates of the breadth of the base were predicated upon inflated estimates of what the Armed Forces actually require. Some have pointed out that even if the entire productive capacity of the nation were devoted to defense, these combined facilities simply could not produce all of the items listed by the military as minimum "musts."

To correct this disparity, Defense Secretary Wilson has come up with the idea of a "production base" as a substitute for the sprawling "mobilization base." The Wilson idea calls for dual-purpose plants wherever possible, instead of the stand-by type. Stand-by plants are presumed to remain idle in peacetime, but would be kept ready for quick return to production if needed. Secretary Wilson's dual-purpose plants would be designed and tooled to run civilian and military production lines virtually side by side. In case of emergency, the civilian line would be converted to defense production, manned by workmen familiar with the machines they were to work with and the materiel to be produced.

Whichever the mobilization program followed, plans are well under way to finance the care of the production lines. The Vance Plan provides for a $2,000,000,000 machine tool pool, $500,000,000 having been set aside in the Truman budget for first-year acquisitions. In addition, after putting the machine tools in place, $300,000,000 is provided yearly for maintenance and modernization.

In-Plant Care

While the Vance proposal is under discussion, the National Industrial Reserve Review Committee has urged Congress to enact legislation authorizing the making of maintenance contracts with firms now using government-owned production equipment. The need for such legislation was stressed by the Committee when studies indicated that the removal of tools to central Government warehouses for storage would result in a delay of about twenty-one months before a plant could get back into production when again needed. If machines were moved to inexpensive storage on or near the site of the private plant, the time lag would be cut to fourteen months. Less time lag would be possible if the machinery were left intact on the private site, but it was felt that the cost of such stand-by storage would be too great.

The Committee urged a piecemeal approach to the stand-by production line. It suggested that about 10 per cent of the equipment be placed in a stand-by status each year for the next five years—the amount to reach approximately 50 per cent by 1958. The cost of maintenance in such a program was estimated at about $75,000,000. The Committee observed that this would be "a modest price to pay for preserving over a five-year period $2,000,000,000 worth of valuable equipment located in plants capable of producing 40 per cent of our military hard goods under conditions comparable to our present military mobilization."

Swan Song?

With the status of the Munitions Board uncertain, many people are wondering whether new rules set by the Board for maintenance of machine tool inventories may have been a swan song. The rules correct some previous defects by requiring that inventory reports include detailed data regarding the condition of equipment.

UNDER the new rules, reports are required from each of the three Armed Services semi-annually. First reports are due September 30, 1953; thereafter February 28 and August 1. Inventories are to include all government-owned machine tools in the hands of contractors, industrial facilities, depots, posts, camps, stations, bases, and active and inactive installations and storage sites.

Inventory records are to include the standard commodity classification of the equipment code; the Federal code for manufacturers; year built; condition of the equipment; location; and the Department Subservice Code. For the last eighteen months, the central inventory has been handled by the National Production Authority, which arranged for the lease of tools to contractors.

The Metal-Working Equipment Division of the NPA has recommended that there be a central inventory of all government-owned production equipment—some 500,000 pieces valued at about $6,000,000,000. The unsettled question is, "Who is to administer the inventory?" The Vance Committee suggested that control rest with the Defense Secretary, the theory being that no one service could then get its hands on more equipment than its programs justified. However, the idea that control had perhaps better be centered outside the Pentagon is gaining support.

Defense Secretary for Supply

Support for the conclusion that the Defense Department is to have more to do with supply is evident in new legislative proposals. The Administration is known to be readying a Reorganization Plan which would transfer to an Assistant Secretary of Defense the functions of such agencies as the Munitions Board and the Research and Development Board.

In drafting such a plan, parliamentarians tried to determine whether an Assistant Secretary of Defense for Supply could be created without amending the Armed Services Unification Act.

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MACHINERY
JUNE 1953

What Users of Machine Tools Think About Depreciation

SEVERAL hundred letters were addressed last month to management executives of machine tool using plants by MACHINERY'S Research Department soliciting their opinions concerning depreciation allowances on production equipment permitted by the Treasury Department in filing income tax returns. It was felt that the findings of such a survey might be helpful to Government officials as they study regulations of long standing that have stifled the modernization of manufacturing plants and actually encouraged the retention of obsolete equipment.

Ninety-seven per cent of the executives who replied expressed the opinion that depreciation rulings should be substantially liberalized; that such a change in tax regulations would be beneficial to the operation of their own companies and industry as a whole; and that the change would result in a higher productive rate throughout industry. Sixty per cent of the returns advocated a definite length of time in which a company should be permitted to "write-off" new equipment, the average time being eight and one-half years. Twelve per cent felt that each manufacturer should be permitted to depreciate his equipment investment at whatever rate he might elect. Another 12 per cent expressed their viewpoint that the rate of depreciation should vary according to the usage or wear to which the specific equipment was subjected.

Thought-provoking excerpts from a limited number of replies are as follows:

"It seems difficult to reason that the Government would pay the farmer for improving the soil to get production and yet penalize the manufacturer for improving his machinery and facility although he creates greater salaries and wages, and makes a tax return to the Government which is far in excess of the farmer's. This incongruity is not explainable, in my opinion. It would help all industry if tax regulations were more flexible on machine acquirement and amortization."—A. P. Higgins, Works Manager, Consolidated Vultee Aircraft Corporation, San Diego, Calif.

"Inflation has been so rapid that if the machine tool is not depreciated in ten years' time and replaced, the replacement costs become so prohibitive that enough money cannot be set aside to keep our machine shop up-to-date. All of us connected with machine tools know that because of the tremendous progress made in producing better tools, a modern plant today can out-produce a plant which is ten years old by probably 100 per cent."—Treasurer of a concern manufacturing paper mill and textile machinery.

"Let each manufacturer decide at what rate he wishes to depreciate the individual pieces of equipment and buildings, requiring only that the depreciation policy be consistent. To illustrate, 75 per cent depreciation one year and none the next would not be acceptable, but 20 per cent each year for five years would be. Some allowance for change should be permitted, but not for inconsistent and violent changes."—Weld Morgan, Vice-President, Morgan Construction Co., Worcester, Mass.

"A more liberal treatment of depreciation would tend to make it even more possible to replace inefficient equipment, thereby either lowering costs (making more taxable profits) or reducing prices to increase the standard of living."—P. G. McAusland, Treasurer, Reliance Electric & Engineering Co., Cleveland, Ohio.

"The aircraft industry is probably the most rapidly advancing major industry in the country. The desire of the Armed Forces and the commercial air lines for larger and faster airplanes has resulted in the need for stronger metals and parts with closer tolerances. As each manufacturing process is developed, new machinery is required. Frequently this machinery is obsolete before it is even installed, due to the rapid advance of technological developments and the fact that the industry must frequently design its own machinery. A large portion of the machinery now being used in our plant and in other plants of the industry is wholly inadequate for the jobs being performed. To improve this situation, millions of dollars should be

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spent for new machines, many of which would be obsolete in one or two years.

"Although tax relief will not solve the problem, higher depreciation rates and a lesser life span on machinery as decided upon by management within the bounds of reasonableness to take care of the obsolescence factor, as well as allowable depreciation rates of 25 to 50 per cent on all machine tools, would be a partial solution."—Vice-president and general manager of a large airplane manufacturing company.

"Much plant machinery, such as foundry equipment, should be amortized over a shorter period than machine tools unless the machine tool be a single-purpose tool subject to early obsolescence. Machinery subject to high abrasive wear might well be amortized within a four-year period, and multiple-purpose machine tools in a five- or six-year period."—Chester V. Nass, Vice-President, Pettibone Mulliken Corporation, Chicago, Ill.

"The prime difficulty with the present tax legislation is that the tax bureau is permitted to make final determination of the allowable depreciation rates rather than the company management. As a result, depreciation rates for tax purposes are often inadequate to recover the plant cost applicable to each year's production. Legislation should be enacted giving the taxpayer the right to determine the useful life of production equipment and to establish depreciation rates."—Comptroller of an outstanding electrical manufacturing corporation.

"I feel strongly that the present tax regulations relating to depreciation allowances are uniquely designed to deter plant modernization and to promote technological stagnation. This problem is made much more serious in a period of inflation and high Federal taxes on income. I believe this statement can be best demonstrated by a simple, hypothetical example. Take the case of a company which purchased a $5000 turret lathe in 1943. According to Treasury Department Bulletin F, a turret lathe has a useful life of twenty-five years.

"In 1953, the company has recovered $2000 of its original investment in the machine. It wants to replace that machine with a newer, more efficient machine—but the replacement will cost $15,000. If it is the company's policy to finance new equipment out of current earnings, it must earn approximately $50,000 under a Federal income and excess profits tax rate of 70 per cent in order to provide the replacement cost of the new machine. It can then recover the cost of the new machine at the rate of only $600 per year. It is my opinion that the period of write-off should be optional with the purchaser of the machine."—Treasurer and general manager of a prominent machine-tool using and building company.

"By restrictive depreciation allowances coupled with high tax rates we find that chances of modernizing our equipment, or investing in other lines, are very much stymied. The concept that depreciation, or the return to the company of investments in equipment, must coincide with the life of the equipment is as ancient as many other concepts which have long since gone by the board. The amortization of an investment in equipment should be permitted in a way that will return the invested money in time for reinvestment in modern or different types of equipment."—Russell C. Flood, Assistant Secretary, A. Schrader's Son Division, Brooklyn, N. Y.

"I believe in the five-year write-off but scaled at 40 per cent the first year, followed by four years at 15 per cent. I do not believe that concerns, especially small and medium-sized businesses, can be strong unless they keep modern. Nor do I believe that the durable goods industries can progress to further developments without a continual replacement of the tools in use. It seems evident that the collection of revenue would not suffer by the above procedure and might really be helpd by a more liberal depreciation policy. It must be remembered that the taxpayer does not get a full refund in the write-off but only that portion which would have gone for taxes on the amount of profit represented by the amount of the investment, and when this amount is written off, the equipment is no longer a tax exemption."—L. C. Buehler, Vice-President and Treasurer, Indiana Gear Works, Indianapolis, Ind.

Indications point toward a substantial modernization of manufacturing plants during the years ahead—a rehabilitation program that would bring our standards of living to even higher levels than we have enjoyed in the past. Such plans should not be throttled by unrealistic administrative interpretations that benefit no one.

Charles O. Herb

EDITOR

FASTEST MACHINING STEELS!

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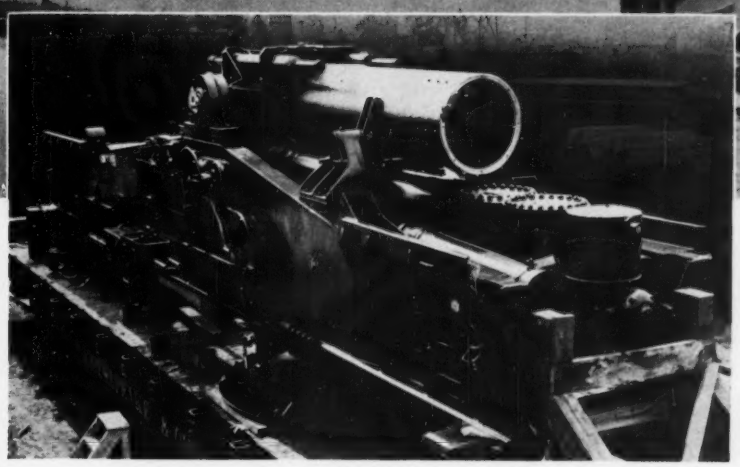
BUILDING CARRIAGES FOR THE ATOMIC GUN



By D. A. BOOTH
General Mechanical Superintendent
Engineering Works Division
Dravo Corporation
Pittsburgh, Pa.

ONE of the outstanding ordnance developments since World War II has been the Army's new artillery piece, a 280-millimeter gun capable of firing an atomic shell. Despite its tremendous size and weight, the gun can readily be transported from one position to another, and emplaced and fired within minutes. After a prototype of the weapon was completed by the Watertown Arsenal, the Dravo Corporation, Pittsburgh, Pa., was awarded one of the prime contracts for building carriage assemblies.

Both the limited number of carriages and the short delivery date for the initial order precluded designing special machine tools and setting up production line techniques. Indeed, the large proportions of many of the components made such considerations impractical. As a result, considerable resourcefulness was required in adapting and using available standard machine tools to meet the specifications of tolerance and finish of the carriages. This article examines several machining operations that are of general interest because of the rather unusual manner in which problems that cropped up were solved in the Dravo machine shop.

The main element of the gun's top carriage

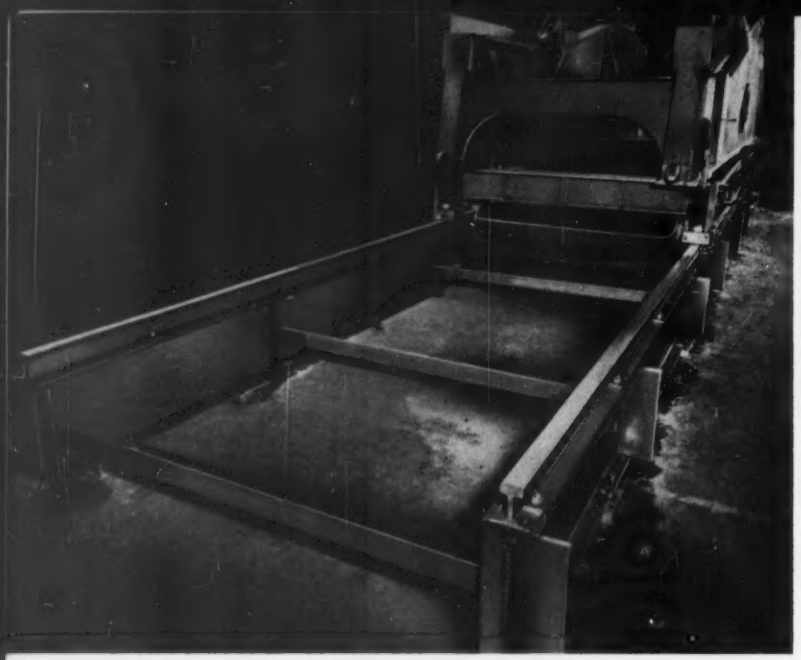
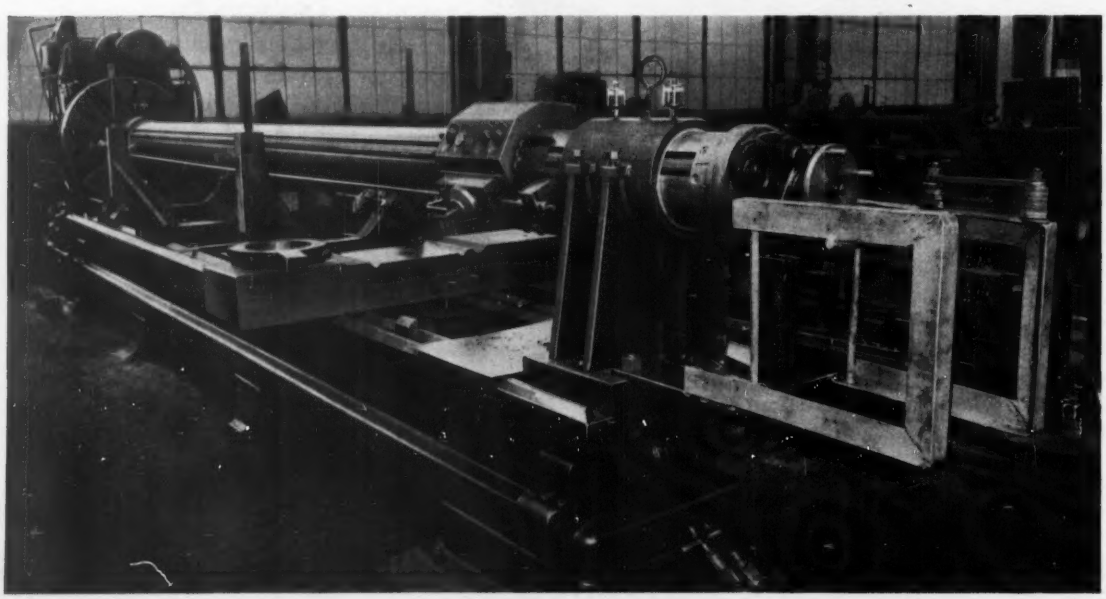


Fig. 1. To extend the planer ways for machining the slides on the 38 1/2-foot carriage, railway track sections and I-beams are employed.

is a stress-relieved weldment, 38 1/2 feet long and approximately 6 feet square in cross-section. Finished surfaces to which the various parts of the assembly are attached must be held in close relationship. Most important of these are the highly machined stainless-steel recoil slides, which form the bottom chord of the carriage side frames. In planing the slides, the limitation imposed by the maximum stroke of the largest available planer (27 feet) was overcome by performing the operation in two settings of the work-fixture.

It had been thought that the overhang of 11 feet from the planer table would be sufficiently resisted by the strength of the fixture and work, particularly since the planing in either fixture setting would be directly over the table. The set-up of the first piece, however, proved this assumption to be erroneous, since the cantilever arrangement threw appreciable distortion well back into the area to be machined. As can be seen in Fig. 1, the problem was solved by constructing an extension to the planer bed of railway track sections on an I-beam frame. Straddling the tracks is a dolly consisting of a heavy beam, the top of which bears the weight of the overhang.

Fig. 2. A traveling-head boring-bar mounted on an old engine lathe performs the preliminary boring operation on the cradle tube.



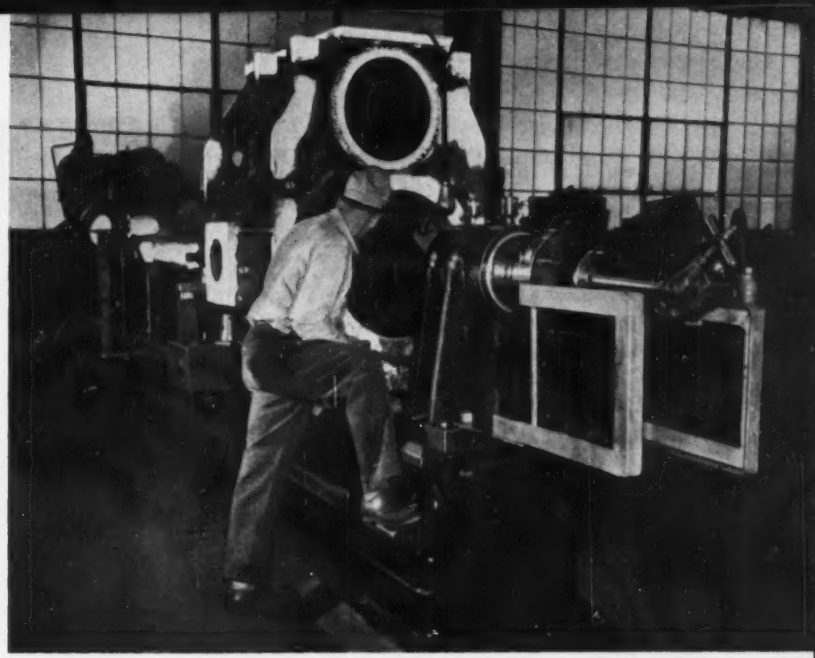


Fig. 3. With the cradle clamped to the lathe bed, the boring proceeds. The lathe was converted from belt to motor drive through a truck transmission.

Hardened wheels on the bottom of the beam ride over the tracks as the planer table reciprocates. (In the illustrated view, the carriage is in an upright position, the planing of the bottom slides having been previously completed.)

The gun cradle, the second largest component of the carriage, is formed from a main tube casting. Welded to this member are the trunnion forgings, which are reinforced with fabricated plates, together with the mountings for the recoil and buffer cylinders, elevating rack, and loading platform. A time-consuming preliminary boring operation on the cradle tube involves recesses and counterbores for seals and bronze liners. Ordinarily, this operation would be performed on a horizontal boring mill, but because of lack of "open time" on such equipment in the shop, it is satisfactorily handled on an old engine lathe that has been equipped with a traveling-head boring-bar.

How the lathe was adapted is shown in Fig. 2. Since the cradle bore has a minimum diameter of 22 inches and a length of approximately 13 feet, an exceptionally rigid bar is required. The bar used was originally a hexagonal spare shaft for the paddle stern wheel of an obsolete river

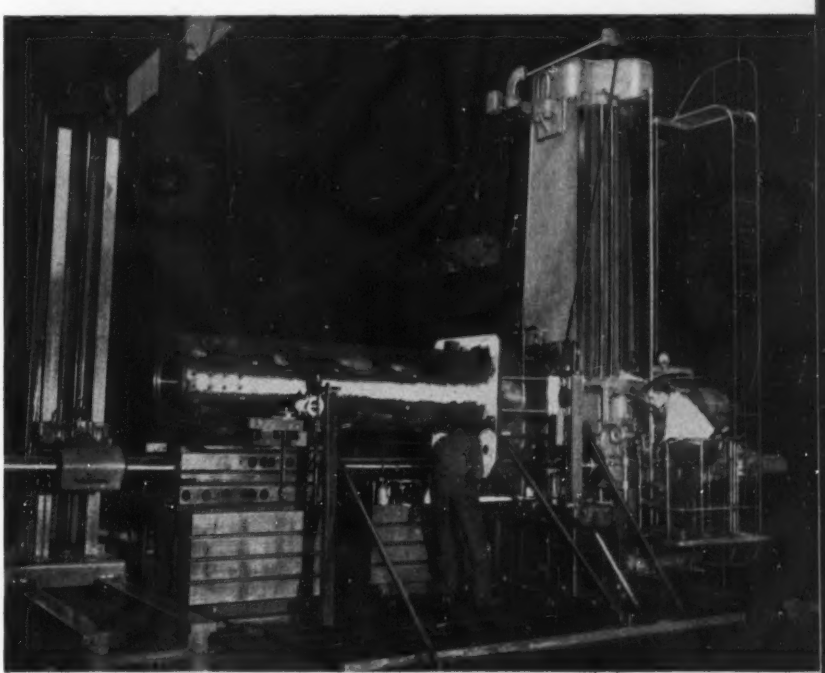
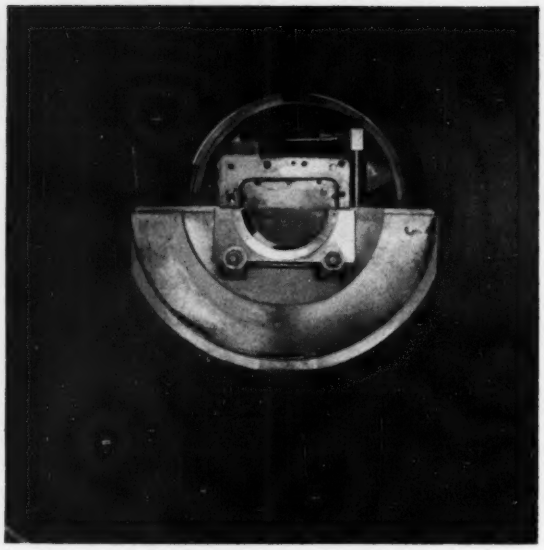


Fig. 4. Finish-boring of liners and recoil buffer cylinders in the cradle tube is handled on this 6-inch horizontal boring, drilling, and milling machine provided with steady bearings for the boring-bar.

Fig. 5. Close-up view of steady bearing in the bore of the cradle tube. The bearing can be adjusted to remove sag from the 15-foot long boring-bar.



towboat. After the corners were planed off, a recess was cut for a feed-screw. The bar was then turned and polished to a 9 7/8-inch diameter. Two large brackets of welded construction are mounted at the ends of the lathe bedways and serve as bearings for the bar. The drive from the chuck is floated, so that any inaccuracies in the lathe are not transmitted.

The boring head is fabricated of two steel slabs. After the inside diameter was roughed out under size, it was welded with bronze to form a dam for a poured-babbitt bearing surface. The split halves then were bolted together and finish-bored to size directly in place after mounting on the lathe.

One section of the boring head contains a tool-holder, constructed in such a manner that the cutter can be advanced or retracted radially by rotating a rod extending the length of the bar. Calibrations on the rod permit 0.001-inch adjustments, so that accurate boring of deep recesses is possible.

To feed the head along the bar, the lead-screw of the lathe was disassembled from the front of the bed and located in the recess of the bar. A feed-gear box, borrowed from shop equipment not in use, was installed at the tailstock end of the boring-bar. Since the feed obtained directly through the gearing and the screw was 0.05 inch

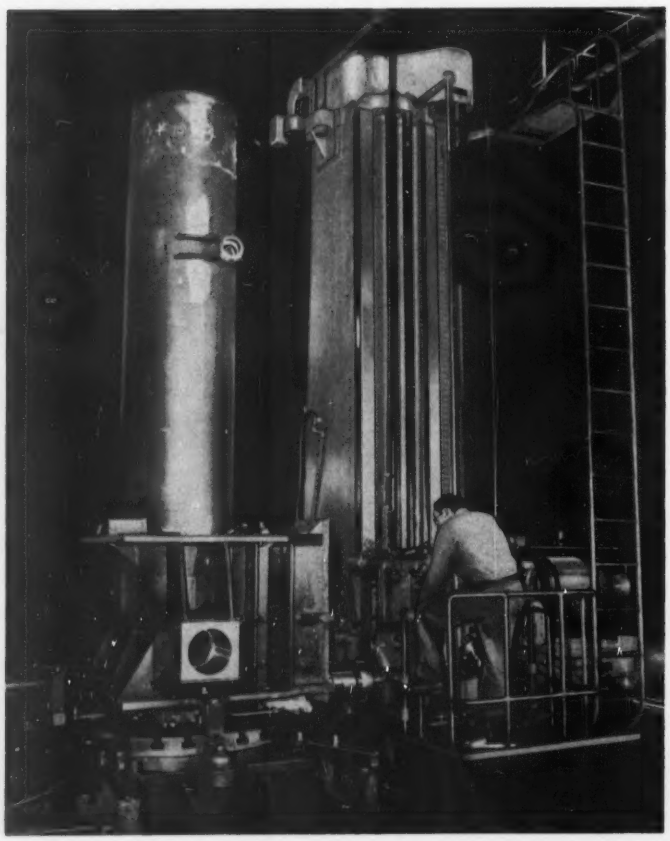


Fig. 6. Rotary table permits the top, bottom, and sides of the cradle to be presented to the horizontal boring, drilling, and milling machine from the initial set-up.

per revolution—too coarse for the required finish and available horsepower of the lathe—a trip mechanism was devised. Actuated by a cam on the bar, the mechanism reduces the feed to 0.0125 inch per revolution through a star-wheel.

In Fig. 3, one of the gun cradles is shown clamped to the bed of the lathe, with the boring operation in progress. The pneumatic drill seen on the frame at the feed-gear box is attached to the star-wheel for rapid-traverse positioning of the boring head on the bar. Cuts of 3/8-inch depth are taken with cobalt-steel tools.

After the preliminary boring of the cradle has been completed on the lathe rig, bronze liners are riveted into the recesses. Then the finish-boring of the liners and boring of the recoil buffer cylinders, as well as the milling of various reference pads, are performed on the 6-inch horizontal boring, drilling, and milling machine illustrated in Fig. 4. When excessive sag was experienced with the 15-foot long boring-bar, a steady bearing, Fig. 5, was fitted into the preliminary bore of the cradle. The bearing can be adjusted to support the boring-bar by means of an extension-handle socket wrench. A similar steady bearing was mounted on the work-table under the cradle to support the bar while boring the recoil cylinders.

In Fig. 6, the cradle is shown set up on a rotary table, by means of which the top, bottom, and both sides can be presented to the machine. Accurate relationships are maintained by indicating pads milled square with each other.

An unusual adaptation of a planer solved the problem of machining a close-tolerance blind keyway extending for about 10 feet along the main bore of the cradle. This keyway engages a key in the cannon tube, serving to resist rotation from rifling torque during the recoil of the gun. Fig. 7 is a view of the planer with the keywaying operation in progress.

The rig, shown separately in Fig. 8, was built upon the runway of a scrapped boring mill. Two 6-inch diameter polished bars extend the length of the runway, and are supported in a bracket at each end. A tool-head, seen at the right-hand end of the bars, forms a sleeve around each bar and carries a clapper-box on its bottom. Between the bars is a draw-rod, bolted at one end to the tool-head and at the other end to the cross-rail. A close-up view of the tool-head is shown in Fig. 9. The keyway is machined by a series of progressively wider cutters which are set up in the clapper and fed down by a ratchet screw on each stroke. Cutting occurs during the normal return stroke of the planer.

Another challenge to the shop was to machine a radius of 281 1/4 inches on the rack-slide. This is the part of the rear float that permits traversing the gun carriage through a given number of degrees of arc. The radius is formed on a planer which has been equipped with a special attachment, as can be seen in Fig. 10.

Instead of setting up the work in the customary manner directly on the planer table, it is held on the base of an old drill press no longer used.

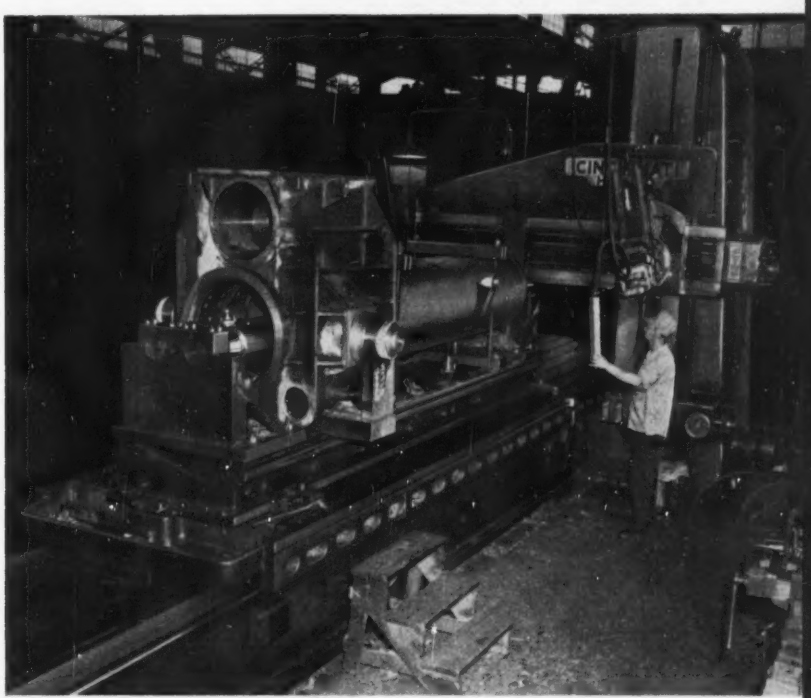


Fig. 7. The keyway in the cradle tube is cut on return stroke of planer. A draw-rod fixes the cutter in relation to cross-rail.

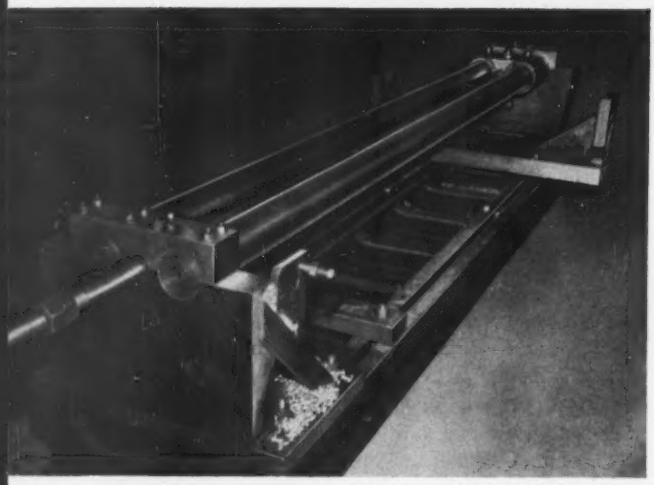
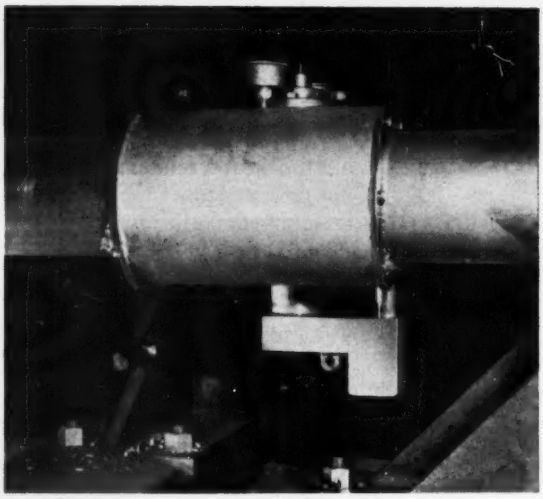


Fig. 8. (Left) To expedite the set-up, the keywaying rig has been mounted on the runway of a scrapped boring mill

Fig. 9. (Below) Keyway cutters are carried in a clapper on the bottom of the tool-head. The two horizontal bars move with the table stroke, the tool-head remaining stationary.

To the side of the base is bolted a triangular frame, pivoting around a standard set on the factory floor a predetermined distance from the side of the machine. One end of the base is connected by an arm and wrist-pin to the planer table. The other end is free on the table.

During the straight-line reciprocation of the planer, the base moves in an arc around its pivotal point. The arm and wrist-pin connection of the base to the table permits the base to adjust itself laterally as the planer strokes, without slipping endwise. A radius gage is used to aid in fastening the rack-slide to the drill-press base, so that the machined surface is exactly 281 1/4 inches from the pivotal point of the triangular member. The rail-head carrying the cutter can then be fixed along the cross-rail to generate the required radius.



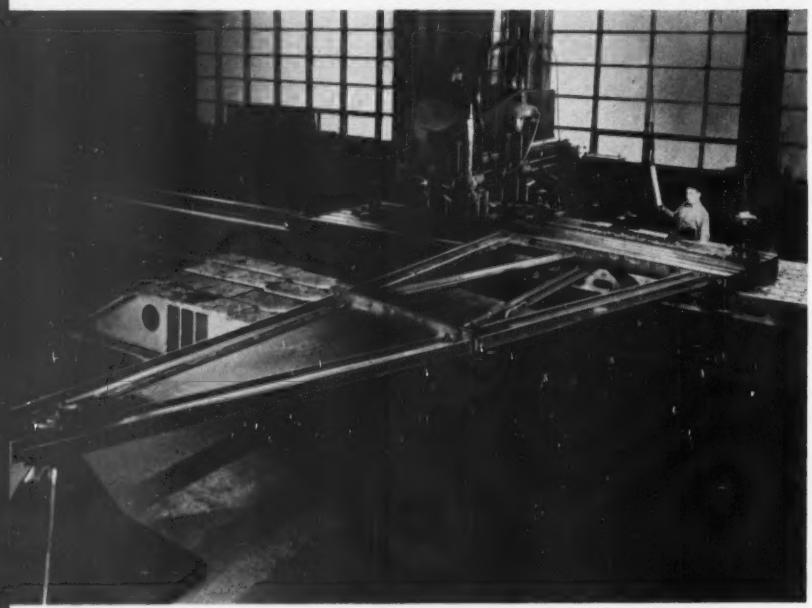
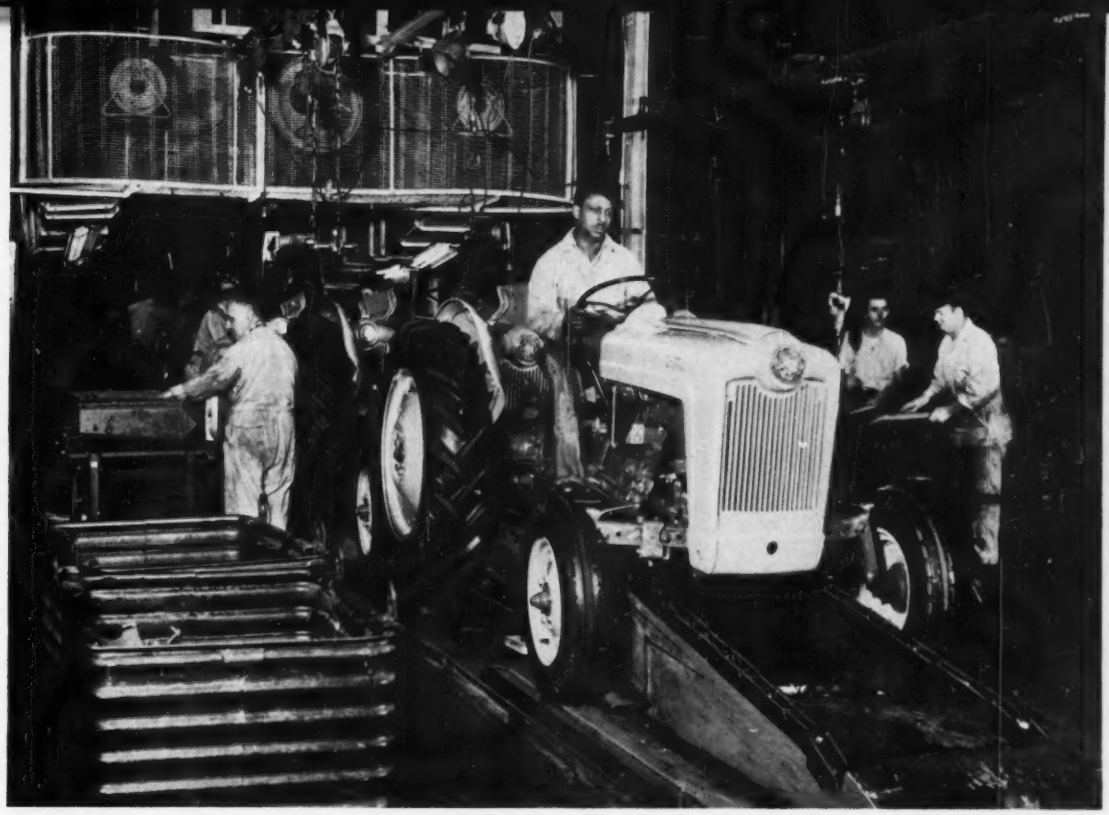


Fig. 10. When the planer table reciprocates, the drill-press base moves in an arc around its pivotal point.



Machining Techniques in a New Tractor Engine Plant

Latest type automatic transfer machines, unique multiple-station rapid indexing machines, and unusual dynamic balancing machines are employed in manufacturing the four-cylinder, overhead-valve engine for Ford's new tractor

By CHARLES H. WICK, Associate Editor

A NEW tractor, called the Golden Jubilee, is being built by Ford Motor Co. at its Highland Park plant—birthplace of mass production in the automotive industry. The heavier, more powerful tractor is equipped with a four-cylinder, overhead-valve "Red-Tiger" engine, which is manufactured on an ultra-modern production line having the latest types of automatic machine tools, materials-handling equipment, and chip disposal systems.

Millions of dollars have been spent retooling for the new tractor and its engine. Giant transfer machines weighing as much as 180,000 pounds, and extending 90 feet in length, automatically convert rough castings and forgings into finished engine parts. Automation is employed to shift the work-pieces from one cutting machine to another. Chips drop from the machines onto conveyors in trenches beneath the floor, and are carried to railroad cars for transportation to remelting furnaces.

Cylinder blocks for the overhead-valve tractor engine are cast with three locating pads on the left-hand side, and two at the top of a flange on the same side of the casting. Initial machining of the cast-iron block is performed on the Ingersoll seventeen-station transfer machine shown in Fig. 1. Each block is loaded into this machine with its front end leading and top side up, and is located against the cast pads. A hydraulically

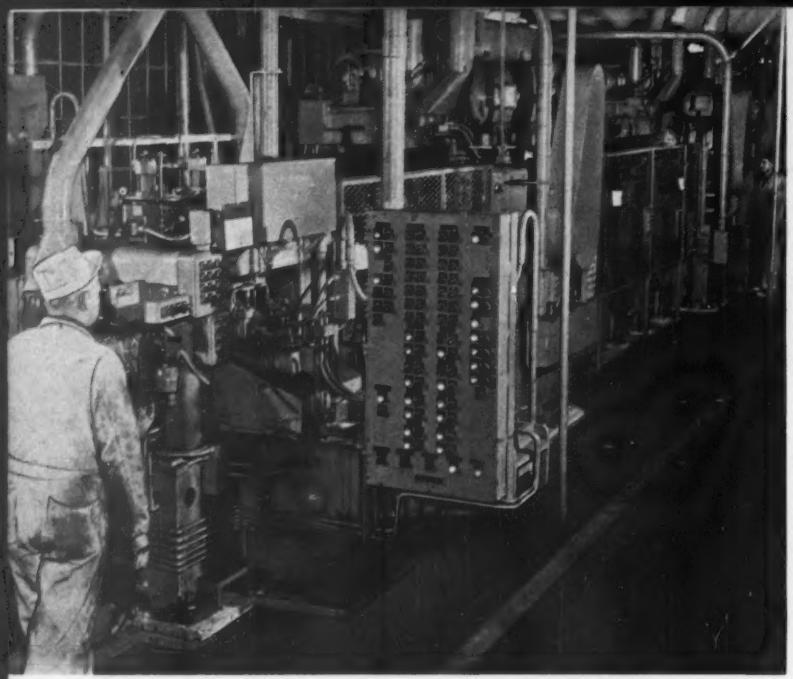


Fig. 1. Cylinder blocks for the overhead-valve tractor engine are milled, broached, drilled, reamed, and chamfered on the Ingersoll seventeen-station machine here shown.

operated transfer bar moves the castings from station to station, and hydraulically actuated clamps grip the blocks at each machining station. Production obtained from this large transfer machine averages forty-five blocks per hour at 80 per cent efficiency.

Four locating pads on each cylinder block are milled by carbide-tipped, inserted-blade cutters at the second station. A turning and loading device at the third station rotates the castings through an angle of 90 degrees and loads them into fixtures. Bearing cap seats, locks, and channels, as well as the bottom face of each engine block, are rough-milled at the fourth station. Mechanism is provided at the fifth station for loading each block into a fixture.

The top faces of the cylinder blocks are both rough- and semi-finish-milled at the sixth station, leaving about 0.015 inch of stock on these surfaces for subsequent finish-broaching. Carbide-tipped, inserted-blade milling cutters, 10 inches in diameter and containing thirty-eight and thirty-four blades, respectively, are employed for these operations. At the seventh station, the blocks are automatically unloaded from the fixtures. Station 8 is idle, and the workpieces are loaded into different fixtures at the ninth station. The bottom faces of the blocks are finish-milled at the tenth station by means of a forty-eight-blade cutter, 14 inches in diameter.

After unloading and reloading at the eleventh station, the bearing cap seats, locks, and channels are finish-milled at the twelfth station. At this station, also, the bearing cap seats are finish-

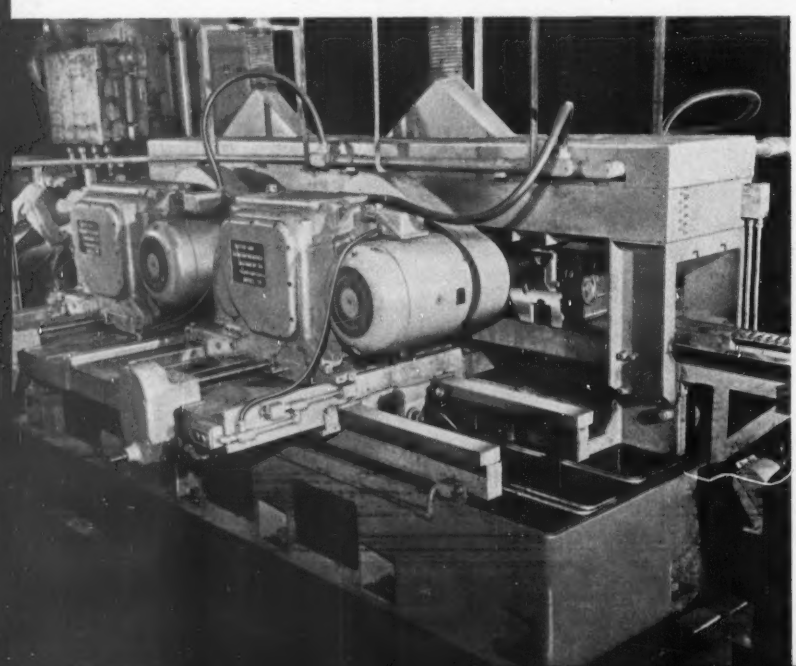


Fig. 2. Each end of the cylinder block is both rough- and finish-milled on this Motch & Merryweather transfer machine.

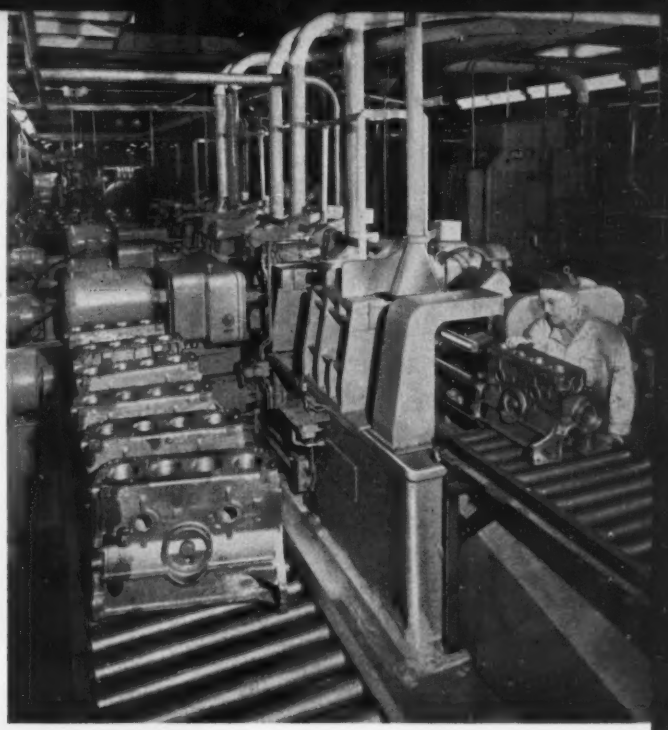


Fig. 3. Cross thirteen-station Transfermatic machine employed to drill, chamfer, tap, ream, or spot-face all holes in both sides of cylinder blocks.

broached, maintaining the required size within plus or minus 0.0005 inch. The fixtures are unloaded at the thirteenth station, Station 14 is idle, and the blocks are turned over 180 degrees at the fifteenth station. Two dowel holes, 3/4 inch in diameter, are drilled, reamed, and chamfered in the bottom face of each cylinder block at the sixteenth and final machining station.

Unloading is automatically accomplished at Station 17, and a roll-over fixture is provided at the end of the Ingersoll machine to rotate the block 180 degrees. The bottom of the block is then facing downward and the front end leading, for entrance into the next machine—a Moline four-spindle machine that rough-bores and counterbores the cylinder bores.

Connected to the Moline boring machine, to form a seven-station transfer machine, is the Motch & Merryweather through type milling machine shown in Fig. 2. Both ends of each tractor engine cylinder block are rough- and finish-milled on this machine. The blocks are automatically transferred past the four huge milling heads—each of which is powered by a 75-H.P. unit. About 1/8 inch of stock is removed from each end by the carbide-tipped cutters. A production of fifty-six blocks per hour is possible at 80 per cent efficiency.

All holes in both sides of the cylinder blocks for the overhead-valve tractor engine are drilled, chamfered, tapped, reamed, or spot-faced on the Cross thirteen-station transfer machine shown in Fig. 3. This Transfer-matic machine performs sixty-nine operations simultaneously, and is capable of completing seventy-one blocks per hour (fifty-seven per hour at 80 per cent efficiency).

A hydraulically operated transfer mechanism moves the work-pieces from station to station—one hydraulic cylinder advancing and retracting the transfer bar, and another rotating the bar slightly to engage or disengage dogs from the blocks. Two more hydraulic cylinders introduce pins into holes in the pan-rail face of the block for locating purposes. The blocks are gripped at each station by gravity-operated, cam-contoured clamps. These weighted clamps are lifted after machining, and held up until the next cycle, by two more hydraulic cylinders. The clamps at the various stations are independent of each other to take care of variations in the size of the work.

The cylinder blocks are loaded at the first station with their pan-rail face down and front end leading. When each block has been indexed to the second station, located, and clamped, a carbide-tipped, fourteen-bladed cutter mounted on a head on the right-hand side of the machine is employed to mill the hydraulic pump pad on the block. The milling cutter is rotated at a cutting speed of 250 feet per minute. This and other milling cutters on the transfer machine are automatically retracted away from the work during the return stroke. By preventing the tools from dragging and marking the work, a smoother surface finish is produced.

Station 3 is idle. A five-spindle head on the left-hand side of the machine at the fourth station core-drills and chamfers two expansion plug holes, and drills and chamfers one oil-filter bolt hole. On the right-hand side at this same station, another multiple-spindle head drills seven more holes varying from 5/16 inch to 1 5/32 inches in diameter. The carbide-tipped core-drills are rotated at 120 feet per minute and the high-speed steel twist drills at 70 feet per minute.

Both left- and right-hand heads at the fourth station are equipped with sufficient spindles to perform machining at the fifth station. The left-hand head is equipped with carbide-tipped cutters to mill the two generator bracket bosses, and rough-bore, face, chamfer, and spot-face the oil-filter hole and boss. The right-hand head drills six holes and chamfers five more. Station 6 is idle, and here holes that have been machined up to this point are periodically inspected.

Nine more holes are drilled in the cylinder blocks by left- and right-hand heads located at the seventh station of the transfer machine. Drills, chamfering tools, and spot-facing cutters at the eighth station machine nine additional holes, and Station 9 is idle. The left-hand head at

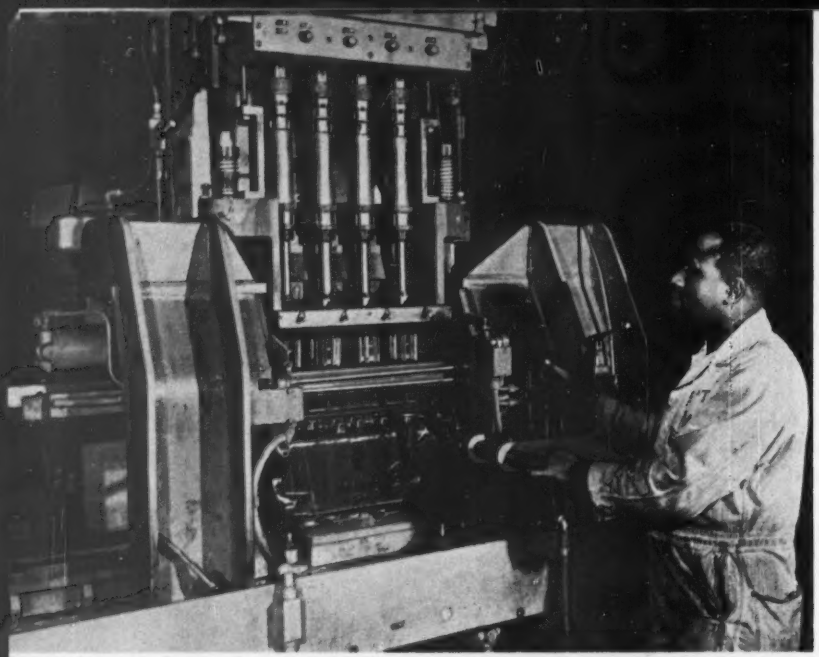


Fig. 4. Sleeves pressed into the cylinder bores in the block are honed within 0.0005 inch of size on a Barnesdril machine with Micromatic head.

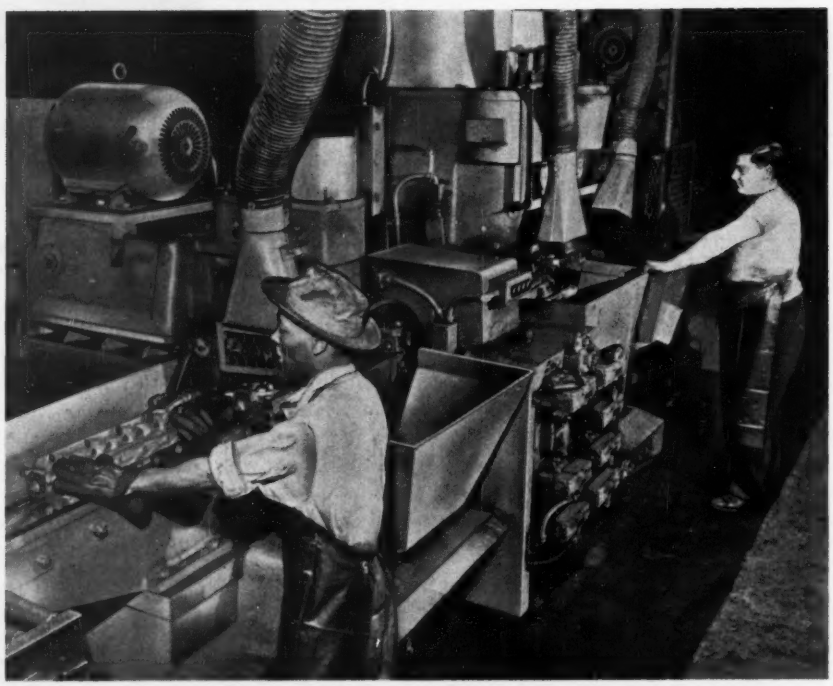


Fig. 5. Contact face, manifold face, rocker-arm support pads, water pump pad, and various bosses are milled on this Kearney & Trecker transfer machine.

the tenth station is equipped with carbide-tipped reamers and cutters to finish-ream two expansion plug holes, and finish-bore and face the oil-filter hole, while tools on the right-hand head drill and counterbore two hydraulic-pump mounting holes. These latter two holes are reamed by carbide-tipped, six-fluted cutters mounted on a right-hand head at the eleventh station.

Station 12 is also idle. Six holes in the left-hand side of the cylinder block and nine in the right-hand side are tapped at the thirteenth and final station of the transfer machine. Individual lead-screw feeds are provided for tapping, and the high-speed steel taps rotate at a cutting speed of 30 feet per minute. An air-oil mist lubricates and cleans chips from the taps.

After pressing sleeves into the finished cylinder bores, the sleeves are honed on the Barnesdril machine illustrated in Fig. 4. The machine is equipped with a Micromatic four-spindle honing head and Microsize automatic control. Size control is attained through an electronically controlled caliper-bar gaging mechanism. Caliper bars incorporated in the honing tools continuously gage the diameters of the sleeve bores. As each sleeve bore reaches the required size, the

corresponding honing tool collapses, and, when all four bores are of the correct size, the honing tools are automatically withdrawn. About 0.002 inch of stock is removed from each sleeve bore, and the bores are held within 0.0005 inch of the required size. Kerosene is employed as the cutting fluid, and a Barnesdril magnetic separator is used to keep the fluid clean. The cylinder sleeves are honed at the rate of 176 per hour (or forty-four blocks) at 80 per cent efficiency.

Cylinder heads for the overhead-valve tractor engine are made from the same grade cast iron as the cylinder blocks. Initial machining of the heads is performed on the Kearney & Trecker seven-station transfer milling machine shown in Fig. 5. The castings are loaded at the first station, seen at the left, with their contact faces down and front ends leading, locating from spots cast in the two outer combustion chambers. At the second station, the rocker-arm pads and nine bosses are milled.

The cylinder head is rolled over, through an angle of 180 degrees about its horizontal axis, at the third station. Both the contact and the manifold faces are rough-milled at the fourth station, with the casting being located from the previously milled rocker-arm pads and bolt bosses, as well as the locating spots cast in the foundry. The contact face of the cylinder head is semi-finish-milled at the fifth station, leaving 0.015 inch on this surface for finish-grinding stock. A water pump pad and a boss approximately 3/4-inch square, located at the front end of the casting, are milled at the sixth station. A section of the transfer table adjacent to this station is automatically lowered to clear the milling cutter as it descends to cut this boss. The cylinder heads are unloaded at the seventh and final station. All of the cutters employed on this transfer machine are carbide-tipped. Approximately 1/4 inch of stock is removed from each of the various surfaces, and a production of fifty cylinder heads per hour is obtained.

Holes in both sides and rear and front ends of the cylinder head are drilled, chamfered, spotfaced, reamed, or tapped on the W. F. & John Barnes eighteen-station transfer machine seen in Fig. 6. A total of sixty-six spindles are used on both the left- and right-hand horizontal and angular heads of this machine. In the first eight stations, the spark plug, manifold bolt, throttle support, fuel tank support, and water temperature holes in both sides of the castings are drilled, chamfered, counterbored, reamed, or spot-faced. These holes are tapped by means of multiple-spindle heads mounted on both sides of the machine at the ninth station.

Both Stations 10 and 12 of this transfer machine are idle, but at the eleventh station the cylinder heads are rotated 90 degrees clockwise in a horizontal plane so that their front ends face the left-hand side of the machine. Then, in Stations 13, 14, and 15, the water outlet, generator bracket support, and expansion plug holes in the ends of the castings are drilled, chamfered, and reamed. The sixteenth station is idle and, at the seventeenth, these end holes are tapped. The cylinder heads are automatically unloaded from the transfer machine at the eighteenth station.

An Ex-Cell-O twelve-station transfer machine, Fig. 7, is employed to machine the valve guide-bushing holes and valve spring seats, generate intake valve seats, and counterbore for exhaust valve seat inserts. Loading of the cylinder

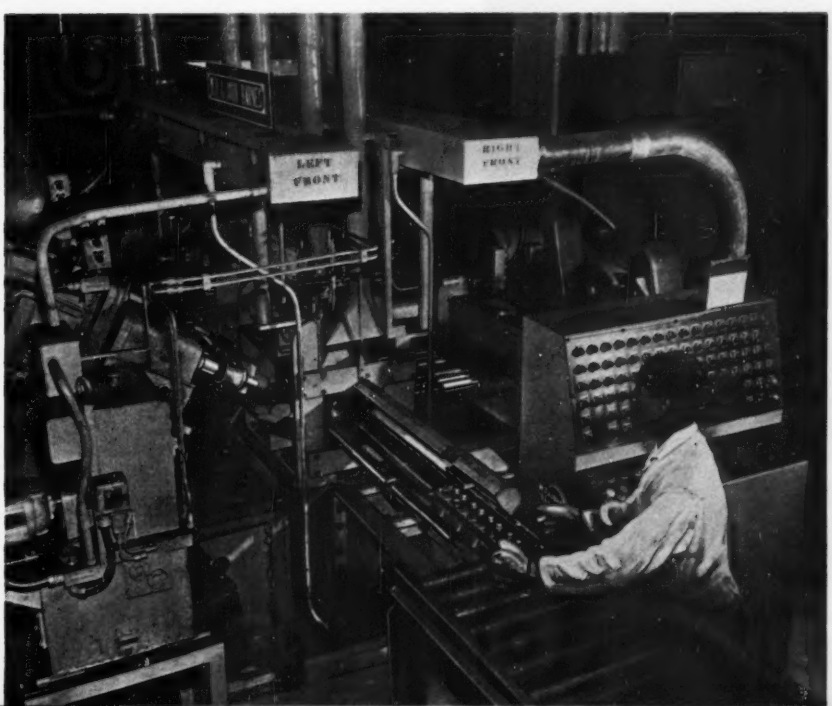


Fig. 6. Loading end of a W. F. & John Barnes eighteen-station transfer machine that drills, chamfers, spot-faces, reams, and taps holes in the sides and ends of tractor engine cylinder heads.

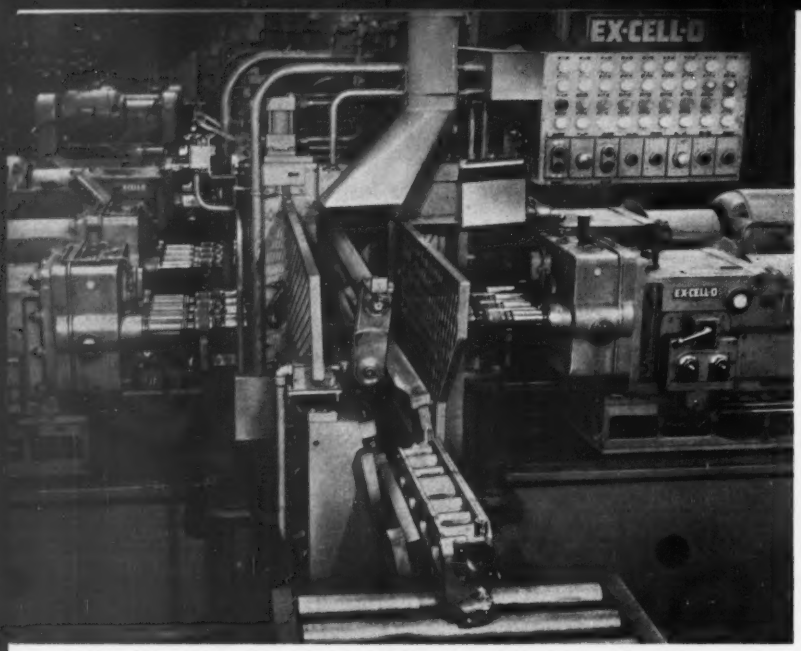


Fig. 7. Valve and valve spring seats, and valve guide-bushing holes in the cylinder heads are machined on this Ex-Cell-O twelve-station transfer machine.

heads is performed at the first station, seen in the foreground. The left-hand head at the second station is equipped with four spindles for rough-counterboring and chamfering two alternately spaced, exhaust valve seat counterbores, rough-form two alternate intake valve seats, and center-drill two exhaust and two intake valve guide-bushing holes. The right-hand head at the same station is tooled to hollow-mill the seats for two exhaust and two intake valves. Form cutters are employed to generate the intake valve seats.

The remaining two exhaust valve seat counterbores, two intake valve seats, four valve guide-bushing holes, and four valve spring seats are machined by means of four-spindle heads on both the left- and right-hand sides of the machine at the third station. Station 4 is idle. The eight valve guide-bushing holes in each cylinder head are drilled through and then reamed at the fifth and sixth stations, respectively. Station 7 is also idle.

Counterbores for the exhaust valve seat inserts and the intake valve seats are faced and finish-machined, and the valve guide-bushing holes are semi-finish-bored at the eighth and ninth stations. Special attachments are employed on the heads at these stations for rotating the facing

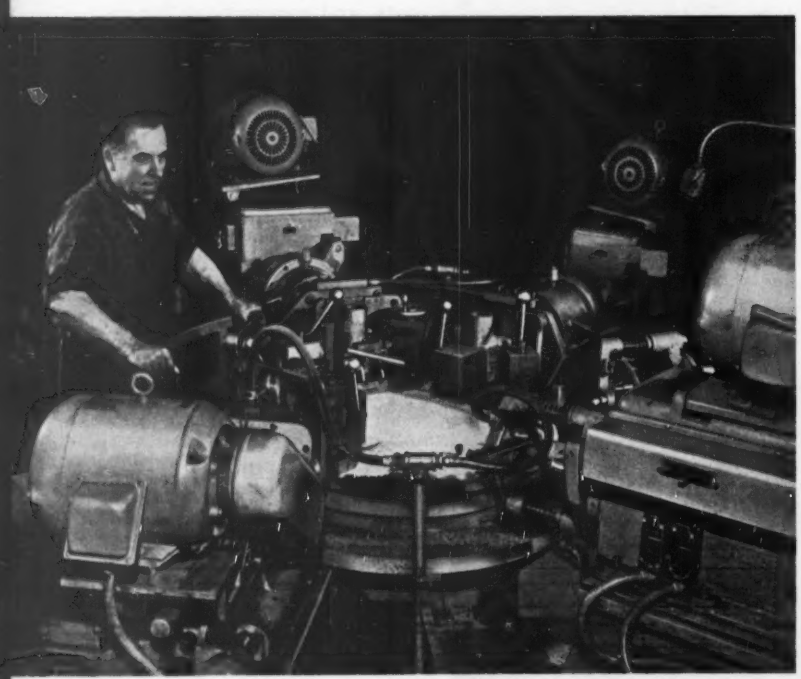


Fig. 8. Five holes are drilled and reamed, and an angular hole is spot-faced, drilled, and tapped, on this Turner Bros. automatic indexing machine.

Fig. 9. A production of eighty hydraulic lift cylinders per hour is obtainable with this quick-indexing machine equipped with six double fixtures.

heads and feeding the tools radially. Station 10 is idle, and, at the next station, the eight valve guide-bushing holes are finish-reamed. The cylinder heads are automatically unloaded at the twelfth and final station of the transfer machine. A production of fifty heads per hour is obtained for these operations.

Hydraulic lift cylinders for the overhead-valve tractor engine are machined on a series of Turner Bros. special, multiple-station indexing machines. A feature of these rapid-acting, high-production machines is a new mechanical indexing table—known as the "Hautau-Turndex"—which is designed to move the work-pieces from station to station in only three-fifths second indexing time. Each cycle of the indexing mechanism is accurately controlled by a master sector gear. The master sector gear, in turn, is controlled by a set of cams that provides rapid acceleration and deceleration of the table without abrupt stops or starts. The automatic indexing machines are equipped with LeMaire heads for drilling, reaming, spot-facing, countersinking, chamfering, and tapping the hydraulic lift cylinders. Each machine is capable of completing eighty cylinders per hour at 80 per cent efficiency.

Fig. 10. Two deep holes, 0.234 and 0.328 inch in diameter, are drilled in three steps at successive stations on this automatic indexing machine.

One of the Turner Bros. automatic indexing machines, shown in Fig. 8, is used for drilling, reaming, and tapping five mounting holes and one oil-transfer hole in the hydraulic lift cylinders. The indexing table of this machine is equipped with six single, manually clamped work-holding fixtures. The castings are loaded and unloaded by the operator at the first station. When each casting has been indexed to the second station, five holes 3/8 inch in diameter are drilled to a depth of 15/16 inch and chamfered. These five holes are reamed to a diameter of 0.3875 inch at the third station. An angular hole in the cylinder is successively spot-faced, drilled, and tapped (1/8–27 pipe thread) at the fourth, fifth, and sixth stations.

Valve body and additional oil-transfer holes in the hydraulic lift cylinders are drilled, spot-faced, and tapped on another Turner Bros. machine, Fig. 9. Because of the close center-to-center spacing of two adjacent holes in each casting, the work-pieces must pass through the machine twice—each part being unloaded and transferred to the other side of the double fixture between passes. The indexing table is equipped with six double-position work-holding fixtures.

Loading, unloading, and interchanging of the positions of the cylinder castings are performed at the first station. A hole is drilled part way in each casting at the second station and then drilled through, into the bore, at the third station. These holes are tapped (1/16–27 dry-seal pipe thread) at the fourth station. At the fifth station, a hole 21/64 inch in diameter is drilled to a depth of 3/4 inch in one casting, and another hole is counterbored to a diameter of 0.92 inch and a depth of 0.72 inch in the other work-piece. Overhead, angularly positioned tools are employed for these operations. The sixth station, shown in the foreground, is idle.

Two holes (one 0.234 and the other 0.328 inch in diameter) are drilled to the required depth in the hydraulic lift cylinders in three successive steps—at the second, third, and fourth stations of the Turner Bros. automatic indexing machine shown in Fig. 10. Two more holes are tapped (1/16-inch pipe threads) at the fifth station, and still another hole, 0.6869 inch in diameter, is reamed at the sixth station.

Crankshafts for the overhead-valve tractor engine are cast from nodular iron, and have a Brinell hardness of about 263. All of the angular oil-holes and the connecting metering, or transfer, holes in the crankshafts are drilled on the Avey twelve-station transfer machine seen in Fig. 11. The crankshafts are slid along rails from station to station by a hydraulically reciprocated transfer bar that extends down the center of the machine. Clamping of the crankshafts in position at the various stations is ac-

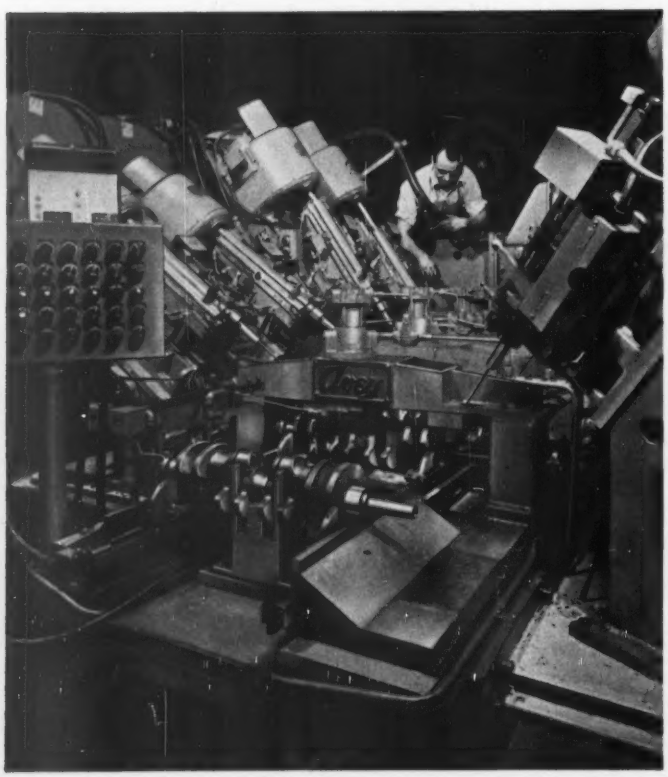


Fig. 11. Avey twelve-station transfer machine for drilling nine holes in each crankshaft. Four of the holes are drilled 5 3/8 inches deep.

Fig. 12. Unbalance in the tractor engine crankshafts is corrected to within 0.3 ounce-inch by dynamically balancing and drilling on this Tinius Olsen machine.

complished with hydraulically actuated horizontal centers (which enter each end of the casting) and vertical V-blocks (which are lowered onto the center main bearing of the crankshaft).

A total of nine holes are drilled in each part, and a production of forty-eight crankshafts per hour is obtained at 80 per cent efficiency. The spindles are equipped with "Avey-draulic" feed, which combines a hydraulic feed with electrical control to provide rapid advance and return, and automatic withdrawal for clearance of chips when necessary. The electric torque reactance unit withdraws the drill automatically when the torsional load at its point reaches a pre-set amount.

The crankshafts are placed in a cradle at the first station, where they are picked up by fingers on the transfer bar. At the second station, two of the 1/4-inch diameter transfer holes are drilled to half depth (approximately 2 11/16 inches), one hole extending from the No. 4 pin bearing to the center main bearing, and the other from the No. 1 main bearing to the No. 2 pin bearing. These two holes are extended to full depth— 5 3/8 inches—by the angularly mounted drill heads on each side of the machine at the third station. The crankshafts are rotated 19 degrees at the fourth station.

The two remaining 1/4-inch diameter transfer holes—one extending from the No. 2 pin bearing to the center main bearing and the other from the No. 3 main bearing to the No. 4 pin bearing—are drilled to half depth at the fifth station, and to depth at the sixth station. The crankshafts are rotated 71 degrees at the seventh station. Oil-holes 3/16 inch in diameter and 1/2 inch deep are drilled in the Nos. 2 and 3 pin bearings and the center main bearing at the eighth station. After rotating the crank 161 degrees at the ninth station, a cross-hole (3/16 inch in diameter and 3/8 inch deep) is drilled in the Nos. 1 and 4 pin bearings. Station 11 is idle, and the crankshafts are automatically ejected at the twelfth station.

Completed crankshafts for the four-cylinder tractor engines are dynamically balanced, and drilled to correct any unbalance to 0.3 ounce-inch, on Tinius Olsen balancing machines such as the one shown in Fig. 12. Each machine is equipped with two drilling heads, a special work-holding fixture, electronic devices, and servomechanisms that permit the crankshafts to be automatically balanced without being removed from the machine. An Electrodyne unit, or "memory brain" of the machine, automatically gives the angular location and the amount of dynamic unbalance, and transmits its electrical signals to set the drills for the correct depth of holes and reference pointers from the angular location of the unbalances.

During balancing, the crankshaft is rotated at 600 R.P.M. Depths of the holes to be drilled in the counterweights at both the flange and pulley ends of the crankshaft are controlled by cams—the cams being set at the required positions by servomechanisms connected to the Electrodyne unit. The operator need only rotate the work to the indicated angular setting, and initiate the drilling cycle. If the unbalance of a crankshaft exceeds 11 ounce-inches, it is necessary to drill more than one hole in one or both ends of the crankshaft. Twist drills 1/2 inch in diameter are employed to correct the unbalance.

From Experimental Design to Production Design

The conversion of an experimental design into a sound, economical production design marks a critical stage in the development of every new product. In this second of a series of articles on dimensions and tolerances for mass production, the author discusses the key factors to be considered and shows how this conversion can be systematically accomplished.

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ONE of the most difficult decisions for manufacturing executives to make is when to release an experimental project for production. This decision depends on many factors, such as the development stage of the experimental device itself; minimum performance requirements; and whether the anticipated needs or desires of the market justify the financial hazards involved. Regardless of the considerations, it is safe to say that any radically new product of appreciable complexity is never fully developed when it first appears on the market.

When the experimental design is accepted for production, if the major effort is to duplicate it without change, the resulting product will be difficult and expensive to make. Under wartime conditions, many new military products are so handled, and most can be described as "toolmakers' delights." Inevitably they require excessive amounts of fitting or relative matching of parts at assembly. This increases the problems of maintenance and repair beyond those following the use of an adequate Production Design. The first few prototypes will be completed sooner if time is not taken to make the Production Design; but when large quantities are needed, a high rate of production at the desired rate will be achieved sooner if an adequate Production Design is prepared.

Comparison of Experimental Design and Production Design

The purposes of the Production Design are many and require a different type of thinking than does the Experimental Design. The Experimental Design has established the particular combinations of mechanical movements needed to obtain the operational characteristics sought for. Whether or not the particular forms and proportions first used are the best is always a question. A rigorous analysis of the kinematics and dynamics of the arrangement will often lead to valuable improvements and refinements in the action. This is one phase of the analytical design as distinguished from the functional.

Choice of Materials—The materials used in the Experimental Design may have been chosen either to give the maximum life in service or to use stock items. In the Production Design, the choice of materials is an important part of the work. The first cost of the materials, their availability in the quantities required, their ease and cost of fabrication, and their strength and ability to resist overloads and excessive wear in service must all be considered. The conditions of service in the hands of customers or the nature of the use and abuse which the product must meet are also factors influencing the Production Design.

Selection of Standard Parts and Sizes—In the Experimental Design, only casual thought is given ordinarily to the use of standard parts and sizes wherever possible. This matter is secondary in importance to the major objective of the Experimental Design—the development of a mechanism that will work. On the other hand, the selection of standard parts and features is one of the essential responsibilities of the Production Design. The component drawings, their dimensional specifications, tools, and gages already exist for these standard parts. The more these can be used, the less the amount of additional preparation required for special equipment. This is still another phase of the analytical design as distinguished from the functional.

Establishing Dimensional Limits and Conditions of Fit—In the Experimental Design, the only attention given to the conditions of fit required is to make the experimental model operate correctly. If the designer's original specifications are not adequate, the mechanic who assembles the mechanism will make the necessary adjustments. Such corrections may or may not be recorded on the experimental drawings. Conditions of assembly and maintenance get little attention from the functional designer.

In the Production Design, these conditions are of paramount importance. The extremes of the conditions of fit must be determined and their limiting conditions must be expressed on the component drawings in such a way that they will be maintained in production. The conditions of assembly must be studied and controlled so that the need of fitting and selective assembly is eliminated or reduced to a minimum. Each individual part must be carefully studied to insure that its form and construction are such that it can be readily reproduced on the manufacturing equipment that will be available. All functional advantages and features of the Experimental Design must be preserved and improved as much as possible. Within these limitations, every effort must be made to redesign the individual parts so as to make them easy to manufacture.

Other Considerations—Each specific experimental design is a problem in itself. The possible simplifications and improvements for production depend upon the particular design in question, its functional purposes, and the nature of its use in service. Sometimes the analytical study of the kinematics and dynamics of the action is of greatest importance. Sometimes the selection of materials for adequate life is the primary consideration. In instrument design, considerations of accuracy of readings will be the most important factor.

The redesign of an existing product to make it meet the needs of improved performance demanded by the customers proceeds along similar lines as the original Production Design in many respects. In fact, if the original Production Design had been carried through completely, there would have been no need for the second attempt. This, however, is a counsel of perfection that is often impossible to follow until experience makes evident the need or desirability of further refinement before production begins.

The only common requirement for all conditions is that the production design engineer be fully acquainted with the particular article—its design, its purpose, the possible methods of its manufacture, and the details of its functioning in the hands of the customer. Much of the Production Design work is an art and must be learned by doing. No text is an adequate substitute for experience. This work involves creative effort of a high order. The wider the background of knowledge and experience brought to the task, the better the results.

Production Design of Three-Jaw Lathe Chuck

The only possible way to present this first phase of Production Design is to give a specific example. The objective of this first phase is to plan an improved product that can be produced at less cost. There are times when the better product must be had even though it be more expensive to make.

The example here used is the small three-jaw lathe chuck shown in Fig. 1. It consists of a body which is mounted on an adapter for attaching it to the lathe spindle; a revolving scroll that has spiral teeth on its face to engage the mating

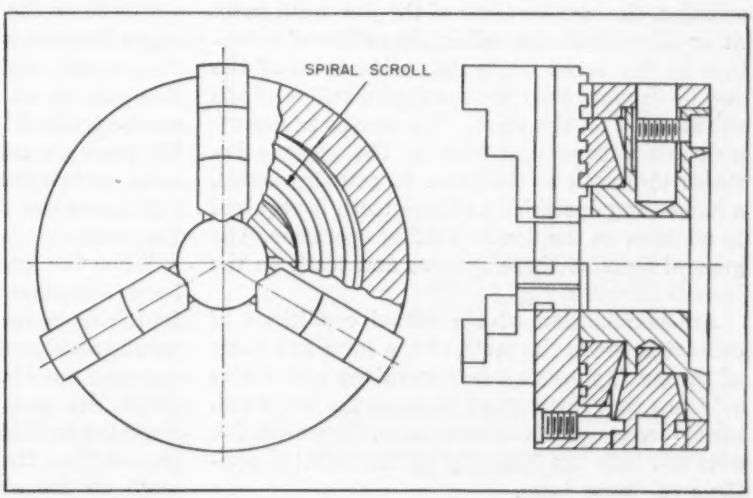

Fig. 1. The performance of this small three-jaw lathe chuck of conventional design could be improved and the manufacturing cost reduced through careful production design.

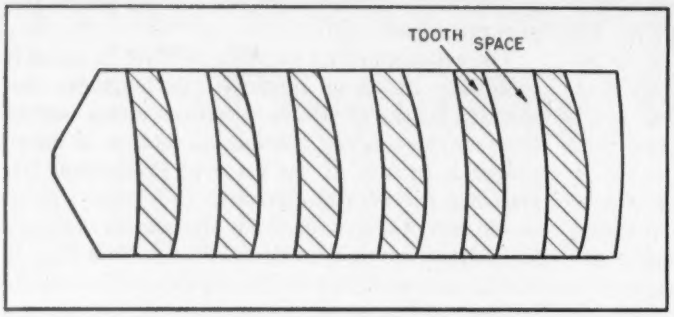

Fig. 2. General form of the grooves and teeth employed on the jaws of the chuck illustrated in Fig. 1

teeth on the three adjustable jaws and with bevel gear teeth cut on its back face to mesh with the three bevel operating pinions; a housing which contains the body and scroll, and has grooves to receive and guide the jaws, and bearing holes for assembly of the bevel pinions; and other components required to hold the several parts together. This is a chuck of conventional design and it has been made and used for many years, during which it has given reasonably satisfactory results in service.

Critical Analysis of Chuck—Regarding the performance of this chuck in service, the major criticism has been that too much eccentricity develops in the work when it is chucked. The run-out of the work may be 0.005 or 0.006 inch or more with the existing design. There are several rather expensive machining operations. Among them are the end-milling of the spiral grooves on the front face of the jaws and the end-milling of the teeth on the jaws.

The spiral on the scroll has a changing radius of curvature, as well as a changing direction of its tangent at different diameters. The jaws travel across the entire face of the scroll so that all teeth of the jaws must be able to engage the teeth of the scroll at every diameter. All the teeth on the jaws must, therefore, be alike. In addition, the outside faces of the jaw teeth must fit or clear inside the minimum radius of curvature on the scroll while the inside faces of the jaw teeth must clear the maximum radius of the spiral curve on the scroll. This makes necessary a double cutting operation on the grooves between the teeth of the jaws. In actual practice, a hand-filing operation on these teeth is required in addition to the double cutting operation. The general form of these grooves and teeth on the jaws is shown in Fig. 2.

An examination of the actual conditions of contact between the teeth of the jaws and those of the scroll shows contact markings which give evidence that the contact between the two members is varying and indeterminate. This condition does not help the accuracy of the relative positions of these jaws.

The first aim of this study of the original design is to find out what can be done to make this chuck center the work more accurately.

Providing Taper Seat for Scroll—The initial design uses a cylindrical bore in the scroll which operates on a cylindrical shoulder on the body of the chuck. Some operating clearance must be present between the two members when the scroll is rotated to clamp the work. In addition, some variation always exists in the diameters of the two surfaces. Because of these variable clearances, even though small, some eccentricity of the scroll in relation to the body is always present. If this is to be reduced to a minimum, the scroll must be held snugly on a tapered seat. As a general rule, where accurate centering is essential, some form of tapered arbor is always used rather than a cylindrical one.

Hence the first change in the design is the substitution of a tapered shoulder on the body and a tapered seat in the scroll in place of the original cylindrical one.

Substituting Angular for Square Teeth—In order to get the full advantage from this construction, the scroll must be held tightly in engagement with the tapered shoulder on the body when the work is clamped by the jaws. The present teeth on the scroll are square. These will not act to hold the scroll tightly on the tapered seat. The second change in design, therefore, is the substitution of angular teeth for the original square teeth. With such a construction, the locking pressure exerted by the teeth will have an axial component which will wedge the scroll tightly on the tapered shoulder on the body of the chuck.

When the locking pressure on the work is released, the scroll should be pushed forward to free it from its tight engagement with the tapered shoulder on the body. The bevel pinion that engages the scroll has axial and radial components. Its radial component is in the right direction to free the scroll if this component is greater than the axial component of the angular teeth on the scroll. When unlocking, the axial

force exerted by the angular teeth on the jaws develops from the frictional force only between the jaws and the grooves in which they slide. When locking, the clamping force exerted through the jaws develops an axial component which is much greater than the radial component developed by the locking force exerted on the bevel pinion. These conditions control the selection of the particular angle used for the faces of the teeth.

Simple approximations indicate that a standard 60-degree included-angle thread form can be used for the teeth on the scroll and jaws. In case of doubt, a simple experiment will give the necessary information. Thus the second change in the design is the substitution of the 60-degree included-angle thread form for the teeth of the scroll and jaws in place of the original square teeth. These first two changes are shown in Fig. 3. There has been no change in the essential features of the functional design.

Adoption of Involute Spiral for Scroll—The next problem relates to the nature of the contact between the teeth of the scroll and those of the jaws. Can anything be done to insure a more definite and fixed line of contact between them? The answer to this entails a study of the characteristics of two different spiral curves which will not be entered into here. The original spiral curve is an Archimedes spiral with an advance or lead of 1/4 inch for each revolution. The question then arises: Is there any other form of a uniform rise spiral that will overcome this handicap of the Archimedes spiral?

The answer is yes. The involute of a circle is also a uniform rise spiral along its generatrix whose rise per revolution along this line is equal to the circumference of the base circle from which it is developed. This form of spiral has the property that the tangent to it is always perpendicular to a line which is tangent to this base circle.

It can be shown that with the substitution of an involute spiral for the Archimedes spiral as the form of the teeth on the scroll, the line of contact between mating teeth is along a fixed straight line which is tangent to the base circle of the involute spiral on the scroll. This insures more definite positioning of the jaws than exists on the original design where an Archimedes spiral was used.

With these changes, the operating conditions of the chuck are materially improved, and it is possible to attain a much greater degree of accuracy in the centering of the work than is possible with a chuck of the original design. Nevertheless, the essential functional conditions of the design are unchanged.

Effect of Design Changes on Manufacture

Consideration must now be given to the problems of actual manufacture. This involves a critical study of every feature of every detail of the assembly. Great effort must be made at this point to anticipate possible changes that will facilitate manufacture without impairing the functional operation of the product. Many of these desirable changes will become evident as the special tools required for manufacture are actually designed. Consideration is given here only to the results of the three changes already made, together with any further developments that may arise from them, to see if the net results of the operational improvements have made the product easier or harder to manufacture.

The change from a cylindrical bearing surface to a tapered bearing surface for the scroll involves more expensive machining operations than before. However, the resulting improvement in operation is worth the additional cost.

Improvement in Method of Milling Scroll—The spiral teeth on the original scroll are produced by an end-milling operation. The diameter of this end-mill is about 1/8 inch. The total length of cut is approximately 23 1/2 inches, since there are about three convolutions of an average diameter

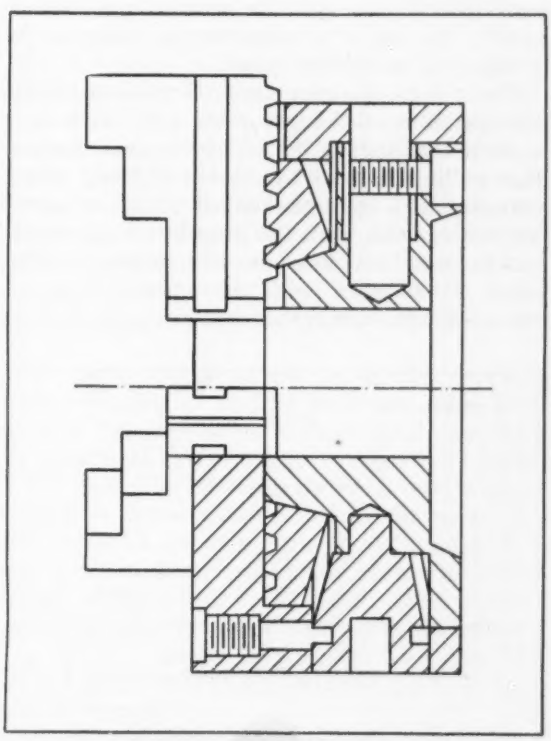

Fig. 3. Improvement in the functioning of the three-jaw chuck is accomplished by using a tapered seat for the scroll and angular teeth instead of square teeth on the scroll and jaws.

of about 2 1/2 inches. This is a long, slow operation. It is performed on a special scroll-milling machine where the end-mill is fed in a radial direction as the scroll is revolved. It is similar to a screw-cutting operation except that the groove is formed on the face of a disc rather than along the circumference of a cylinder.

The same scroll-milling machine can be used to machine the angular thread or groove with a tapered end-mill whose axis is positioned a distance of 0.0398 inch to one side of a radial line of the scroll. Nothing, however, would be gained here as regards the economy of manufacture. It is possible that with the angular grooves a cutter of larger diameter can be used, in the form of a thread-milling cutter, with the axis of the cutter parallel to the face of the scroll instead of perpendicular to it. In fact, a multiple-toothed cutter with annular teeth, similar to a thread hob, can be used so that the grooves are machined in a single revolution of the scroll.

The maximum diameter of the cutter, however, is limited by the curvature of the spiral grooves. The path of the cutting edges of the cutter as it goes into and comes out of engagement with the grooves of the scroll must lie inside of these spiral grooves of the scroll. The next step, therefore, is to determine the maximum possible diameter of such a cutter that will avoid interference with the grooves, and then to specify the use of a cutter whose diameter is within this maximum value.

There is no question that the milling of the spiral grooves on the face of the scroll with such a thread-milling cutter is better and cheaper than milling them with an end-mill of very small diameter. If a multiple-toothed cutter or annular hob is used, then the grooves on the scroll can be completed in a single revolution of the scroll. In addition, with the angular form of thread, the grooves in the scroll can be accurately ground after hardening whenever it may be required. Here we have an improvement in the product combined with a reduction in the cost of manufacture.

Double Milling Cut Replaced by Single Operation—The next problem relates to the form of the teeth on the jaws. Only line contact can exist between the mating teeth of jaw and scroll because of the changing curvature of the spiral grooves in the scroll. Instead of using a double cut to machine the grooves in the jaws, if these teeth are made as a substantial duplicate of a section of the annular hob which is used to machine the scroll, they can then be machined by a single circle milling cut as indicated in Fig. 4. In this case, the expense of milling them is much less than for the double milling cut required on the original design. In addition, such a form better insures the type of contact needed for accurate centering of the chucked work.

Summary—There is no doubt that the performance of the revised chuck design will be much better than that of the original design. The change to a tapered bearing surface for the scroll increases the manufacturing cost; but the change in the tooth form for the scroll and for the jaws, with the use of an annular cutter or hob for the scroll and with the circle milling of the teeth on the jaws, reduces the manufacturing cost much more than it is increased by the introduction of the tapered seat for the scroll. Hence the net result of this part of the Production Design is an improvement in performance and a reduction in manufacturing cost.

Careful studies of this type on any new mechanical product always show chances of similar improvements. The foregoing is one example of the analysis of the details of a design to determine the possibilities of improving the operation of the product and of reducing its cost of

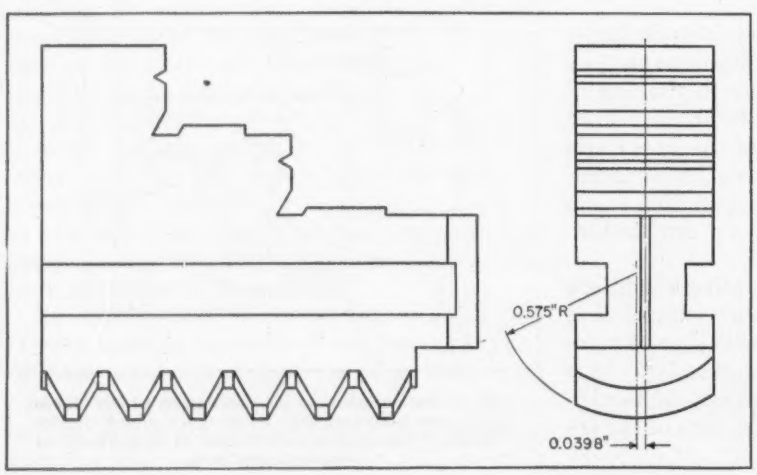

Fig. 4. The shape of the teeth on the redesigned jaws permits one instead of two milling cuts, and insures better tooth contact between scroll and jaws.

manufacture. Similar studies on other mechanisms will show ways and means of getting similar results. Each product presents a special problem of its own.

Making Use of Standardization

In addition to this first phase of the Production Design, there are many other features of the design of an item where careful study and attention to small details will show many ways of reducing manufacturing costs without impairing the functional operation of the product. For one simple example, tapped holes should be through holes wherever possible. If a blind hole must be tapped, provision should be made so that the depth of the drilling is sufficiently deeper than the depth of the threading to avoid the need of a bottoming tap to finish the thread.

Standard Tools, Parts, and Sizes—Standard tools and standard sizes should be used wherever possible. Such a practice eliminates the need for special tools and special gages which not only add needless expense but also involve a longer time to make or to get the special tools and gages. A list of preferred standard sizes should be established and followed so as to reduce the variety to a minimum. Most engineering departments make up their own lists or books of standards. These include items selected from other publications as well as many other plant standards developed by themselves for their own particular needs.

Many standard parts can be bought at a much lower cost than they can be made in the smaller quantities required by any individual manufacturer. Many such standard parts are listed in publications such as the ASA Standards, *S A E Handbook, Machinery's Handbook,* manufacturers' catalogues, and other sources. These publications should be available to the designer. Such standard parts should be used wherever possible. Much time and thought have gone into the development of these standards and the chances are that their use wherever applicable will give better results than some special inspirational design that has not been thoroughly analyzed and tried out in service.

Using Preferred Number Series to Reduce Variety—One potent practice toward reduction of manufacturing cost is the reduction of variety of any standardized feature or detail. In other words, the number of different sizes of any detail should be reduced to a minimum. To cover a definite range of size to the greatest advantage, the steps or differences in size should be in a geometric rather than in an arithmetic ratio. Then the percentage change in size is a constant so that it is always possible to select a size within a given small percentage of any size in the given range. Standards for this purpose are explained and listed in the American Standard Z17.1-1936. The values in Table 1 are taken from this standard and give the decimal series of preferred numbers from 10 to 100. Values for larger or smaller numbers are obtained by shifting the decimal point as required.

Table 1. Decimal Series of Preferred Numbers 10 to 100

5 Series	10 Series	20 Series
10	10	10
		11.2
	12.5	12.5
		14
16	16	16
		18
	20	20
		22.4
25	25	25
		28
	31.5	31.5
		35.5
40	40	40
		45
	50	50
		56
63	63	63
		71
	80	80
		90
100	100	100

As an example of the application of these preferred numbers, it is assumed that a series of sizes for the diameters of handwheels is needed to cover a range of from 4 to 16 inches. A selection from the 10 series gives the following diameters for these handwheels: 4, 5, 6.3, 8, 10, 12.5, and 16 inches. This gives seven sizes to cover this range with an increment in diameter of about 25 per cent. These sizes should certainly meet any needs in design within this size range.

The same treatment can be applied to any other reduction of variety program. Take, for example, the thicknesses of sheet metal. Suppose the desired thickness range is from 1/32 inch to 1/8 inch. The 20 series could be used which would give thirteen thicknesses in this range. If this should be too many, the 10 series could be used which would give the following seven thicknesses: 0.032, 0.040, 0.050, 0.063, 0.080, 0.100, and 0.125 inch. If smaller differences are needed between the smaller thicknesses, then the 20 series could be used at the start and the 10 series used at the end.

Another opportunity for the use of this standardization and reduction of variety policy arises when the need of redesign and coordination of design of a variety of sizes of similar products

becomes evident. The product may be internal combustion engines of different sizes, oil pumps of varying capacities, or anything else.

In the course of time, several sizes may have been developed to meet immediate needs. If the whole line is redesigned at the same time, many opportunities will arise of so designing the several sizes that many details will be common to several or all of the sizes. When this work is finished, it may well be that the number of different component parts to be manufactured to assemble, say, five different sizes of product will amount to only about twice the number of different component parts required for a single size. This will result in the production of a smaller variety of individual details than before, with the consequent reduction of manufacturing costs.

Establishing Adequate and Economical Fits

Provision of Suitable Clearances—Adequate clearances are vital factors of all operating mechanisms and are essential to interchangeable manufacturing. Many skilled mechanics hold to the fallacious belief that tight or close fits are essential to high-class workmanship. All sliding or revolving operating parts must have adequate clearances to provide space for the oil film needed between them and to allow for differences in their thermal expansion when in operation. The clearances required depend upon the conditions of operation, the characteristics of the materials used, and the particular features of the design. These may often need to be determined by actual trial. Every part of a mechanism must be definitely located or have its position definitely controlled in three directions to keep it in its proper position. Every operating part must be located with suitable operating clearances. After the requirements of location are met, all other surfaces must have liberal clearances. Inadequate clearances lead to interferences in operation.

A design that will permit the use of liberal clearances is one of the main objectives of the Production Design. That construction which permits the most liberal clearances without sacrifice to the functional operation of the product is the best.

Working Toward Liberal Tolerances—Closely allied with the clearances are the tolerances. The manufacturing arts have not yet reached the point where identical parts can be produced. Some variation in size and form and position is always present. The amount of the clearances is therefore variable. The difference between the maximum and minimum clearances between mating surfaces establishes the sum of the tolerances on the two surfaces. The minimum clearance should be the least that the satisfactory operation of the mechanism will permit. The maximum clearances should be the most that the functional operation and a reasonable length of useful life will permit. Wear may take place on some of the operating surfaces. Adequate provision must be made for it. The maximum clearances should not be so great that the product is close to its worn-out condition when it is first assembled. Thus the conditions imperative for correct operation should control both the minimum clearances and the tolerances.

A common tendency in the past has been to establish tolerances on the basis of holding the sizes as closely as possible to a fixed size. This practice reduced the tolerances to the least—or even less than this—that could be maintained by the most careful manufacturing practices. Such a practice does not lead to economy of manufacture or to a high quality of product.

The knowledge of the utmost degree of accuracy attainable by a given metal-working process is indeed invaluable when the Production Design is being made, but once the general features of that design have been established, attention should shift to the adequate functioning of the completed mechanism. Past experience shows that in many cases the original tolerances are increased during the course of continued production without detriment to the operation of the product. It is a rare exception when a tolerance must be reduced. It is natural for the designer, when in doubt, to make the tolerances as small as possible, but all close tolerances should be rechecked carefully before they are accepted.

The correct minimum clearances can be determined quite definitely for most cases in the early stages of the work—the manufacturing model is of great value in this respect—but the maximum possible clearances become established only after extended experience with the specific product. It is seldom that these maximum clearances are ever reached, because before that value is reached the tolerances have become so liberal that there is no need from the standpoint of economical manufacturing for further increase.

Other Factors Affecting Assembly

Confining Critical Surfaces to a Single Unit—An analysis of any mechanism will show that there are relatively few critical functional surfaces that require extreme care in manufacture. Often in a redesign these critical surfaces can be arranged compactly in some unit assembly that can be assembled and tested by itself. The more the design lends itself to this end, the more economically it can be reproduced. For example, a watch or clock consists of a spring motor, an es-

capement mechanism, a gear train, indicating hands, a dial face, and a case. The only critical functional surfaces are a few of those of the escapement. These may total but six or seven. With an accurate escapement, the watch will keep good time. All of the other surfaces are of secondary importance as regards correct operation.

Employment of Unit Assembly—The final assembly is very much simplified when the design permits such unit assembly. Every effort should be made to obtain this result. There are many other advantages of this unit assembly construction. Not only the several manufacturing departments of a given factory but also entire plants are specializing more and more. When such unit assemblies are of equal value to several products, separate plants are equipped to produce them. This creates opportunities of greater volume of production, with all the attendant economies, than would otherwise exist.

Facilitating Assembly and Servicing—In the Production Design every effort must be made to arrange the construction so as to facilitate the ready assembly of the product. Parts that may require attention or replacement in service must be accessible. This is a feature that is often overlooked. Attention to these details will reduce assembling and servicing costs. The latter must be considered if ultimate economy is to be insured.

Reviewing Service Experience—The actual service requirements of a new product are often the most difficult to determine. Time and continued experience in the use of the product are needed to obtain this information. Experiments and endurance tests in the laboratory in themselves are insufficient to uncover this information. After a product is on the market, it receives use and abuse that the manufacturer never dreamed of. Yet if it fails under these unforeseen conditions, the manufacturer is blamed. Obviously, the nature of the product controls in some degree the service it is expected to render. The designer should see all complaints from customers and have the chance to investigate all those that appear to be important, so that all possible improvements in the product can be made. The Production Design itself is never finished as long as the product is being manufactured.

The service requirements include the protection of the working parts from dirt and other foreign matter, the provision of effective lubrication, and the protection of the operator from moving parts. The question of the best preservative finishes—such as japanning, plating, and painting—must also be answered to meet the service requirements of use and abuse and appearance. For these and many similar problems a solution is sought that will give the maximum amount of useful service at a minimum cost.

Need for Manufacturing Models—It must be realized that the Production Design is not undertaken with the idea of willfully altering the Experimental Design, but is made to improve the operation of the product, to facilitate manufacture, and to furnish as much as possible of that vast amount of detailed information formerly brought to the productive work by the skilled mechanics who carried out the inventor's ideas. The alterations made in the Experimental Design should never be regarded as criticism of the original lay-out. Each type of design has its distinct purpose. In case of any question as to the effectiveness of proposed changes, a manufacturing model should be made and tested to settle the question definitely.

When this first phase of the Production Design has been completed, several manufacturing models should be made to prove it. It is more economical to correct a fault on such samples than it is to salvage or scrap a large number of parts after production is started, with the additional expense of correcting the manufacturing equipment. Besides, endurance and overload tests on some of these manufacturing models may save the embarrassment of correcting or replacing some of the first units of production after they have reached the hands of the customers.

* * *

Rapid Method of Measuring Carbon and Sulphur in Steel

Previous to the introduction of high-frequency heating, carbon and sulphur contents in iron and steel had to be determined with two separate, conventional tests. With resistance type element furnaces formerly used, it took twelve to fifteen minutes per sample to obtain the carbon content and twenty minutes was consumed to test the sulphur content by the evolution method, a wet chemical process. The reaction of certain alloys was detrimental in using both processes.

Now carbon and sulphur contents in all types of ferrous alloys can be determined by means of a newly developed procedure introduced by the Laboratory Division of the Lindberg Engineering Co., Chicago, Ill. The new method, which employs radio-frequency inductive heating, tests for both carbon and sulphur in a single operation in ten minutes. This represents a time saving of twenty-two to twenty-five minutes over conventional methods. The Lindberg high-frequency combustion unit is capable of heating samples to temperatures above 3000 degrees F.

Micro-Inch Inspection in the

ON the theory that measurement leads the way—that a part that can be measured, can also be produced—the Canton, Ohio, plant of the Timken Roller Bearing Company has developed one of the finest gage laboratories in the United States. This laboratory is the keystone of the inspection department, which has complete responsibility for the inventory and accuracy of some 500,000 tools, reference gages, and working gages used in all of the company's plants. Many of these gages are accurate to 0.00001 inch, making it entirely practical to hold critical dimensions of Timken tapered roller bearings to within 0.00002 inch.

Part of the 2500-square foot modern laboratory can be seen in the heading illustration. A dust control unit cleans the incoming air. Temperature is maintained constant at 68 degrees F.; relative humidity, at 40 per cent. The laboratory's personnel consists of fifty people who perform a variety of jobs.

Inspectors check tools, gages, and machine parts for size, surface finish, and material defects. Hand lappers in the laboratory finish the more precise parts that cannot be ground to the required accuracy. Others check and repair the several thousand dial indicators and instruments used in the various plants. Clerks maintain an elaborate card inventory of the blueprint number, frequency of use, location, replacements, etc., of every item for which the inspection department is responsible. Groups of inspection apprentices, always present in the laboratory, are training under a four-year program.

A high degree of liaison exists between the laboratory and the tool-room, which adjoins it. All tools and gages made at Canton are returned to inspectors after each machining operation. They, in turn, assist the toolmakers with their more difficult problems.

One highly prized piece of equipment is a huge surface plate, 36 inches wide and 60 inches long, made of Graph-Mo tool steel—a product of the company's Steel and Tube Division. It was made from a forging originally 10 inches thick and weighing 3 tons. The load of the plate is carried uniformly on a 5-foot deep concrete foundation, and a 2-inch layer of compressed cork between the plate and the foundation keeps all stresses from reaching the plate. Flatness over the entire plate surface within 0.00007 inch was obtained after 1568 hours of lapping following hardening and grinding.

Several typical uses of the plate can be seen in Fig. 1. On the left is a set-up for a length check of a ring gage used on cone-roller assemblies. In

Timken Gage Laboratory

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Fig. 1. So perfect is the finish of this surface plate that molecular adhesion is produced when precision gage-blocks are wrung on.

the center is a set-up for checking the taper of a cone gage. This gage is accurate to within 0.0001 inch in the length of the gaging surface. On the right, the inspector is shown checking one of four roller masters for size and taper on a flat sine bar set to precision gage-blocks to within 0.0001 inch. An electronic comparator is used in conjunction with this operation.

Many lineal and diametral inspections are made by means of Zeiss optimeters. These are optical instruments that substitute for the lever arms of mechanical measuring devices a beam of light traveling over a scale in accordance with the movements of an inclinable mirror. The main element of the optimeter is a telescope equipped with an ocular having a glass scale laterally behind it at one end, and a pivoting mirror on a contact plunger at the other end. Any movement of the contact plunger tilts the mirror, shifting the scale image an amount equal to the product of the

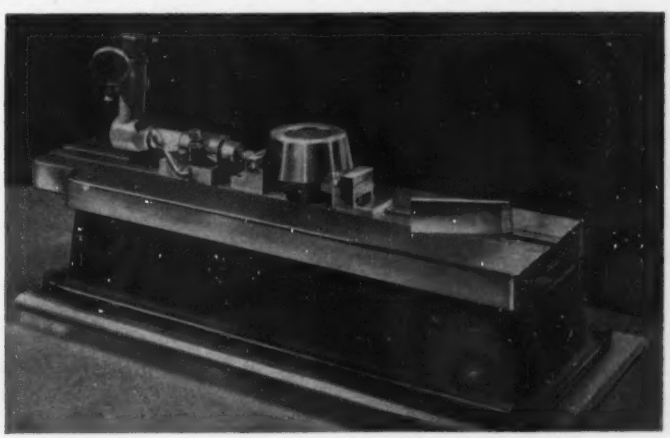


Fig. 2. For this master sizing machine, the optimeter is mounted horizontally. A prism in the optimeter telescope bends the light beam 90 degrees, transmitting it to the ocular.

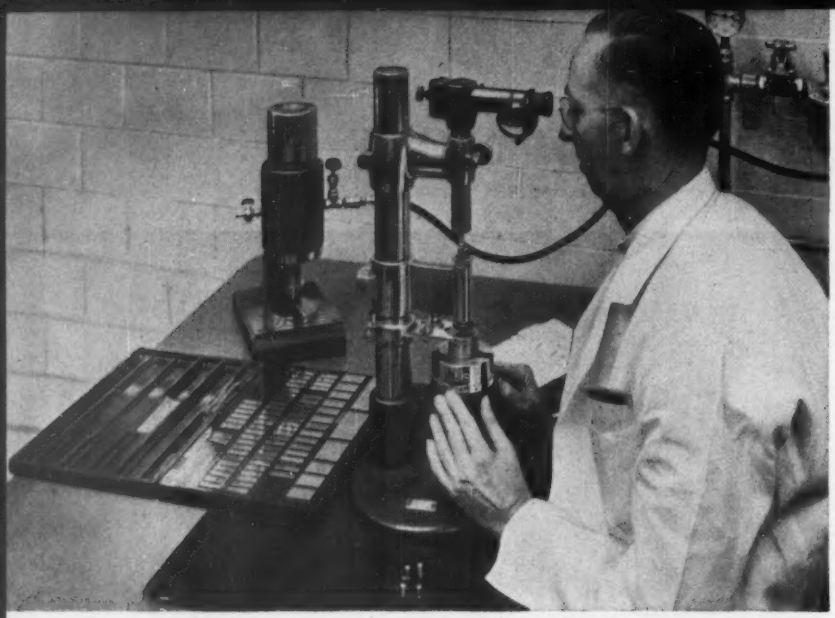


Fig. 3. Here, the optimeter is mounted vertically. Some optimeters are equipped with an indicator, consisting of colored glass plates which limit the permissible tolerance to a bright field.

movement of the beam of light and the magnification of the scale by the lens system. A 0.00005-inch movement of the plunger, for example, is translated into a 0.05-inch shift of the image.

Three important uses of the optimeter in the gage laboratory are illustrated in Figs. 2, 3, and 4. Plug gages that control the taper of Timken roller bearings are checked on the sizing machine, Fig. 2. Here, the optimeter is set up to compare the diameter at the theoretical sharp point of the large end of the taper. With the gage resting on its face, the distance is compared across two dovetail blocks containing wires which are in contact with the taper.

In Fig. 3, the size of a tapered roller master is compared with a reference tapered roller master by measuring the drop in a tapered ring gage. The air cylinder seen to the left of the optimeter is used to seat the tapered roller master in the ring gage at a constant pressure before checking. Accuracy between reference and work masters is maintained within 0.0000125 inch.

The optimeter is an integral part of the Zeiss universal measuring machine, Fig. 4. An outside diameter standard is shown being measured, and the reading obtained will be accurate within 0.00002 inch of length. The contact points of the machine are adjustable along the bed to outside

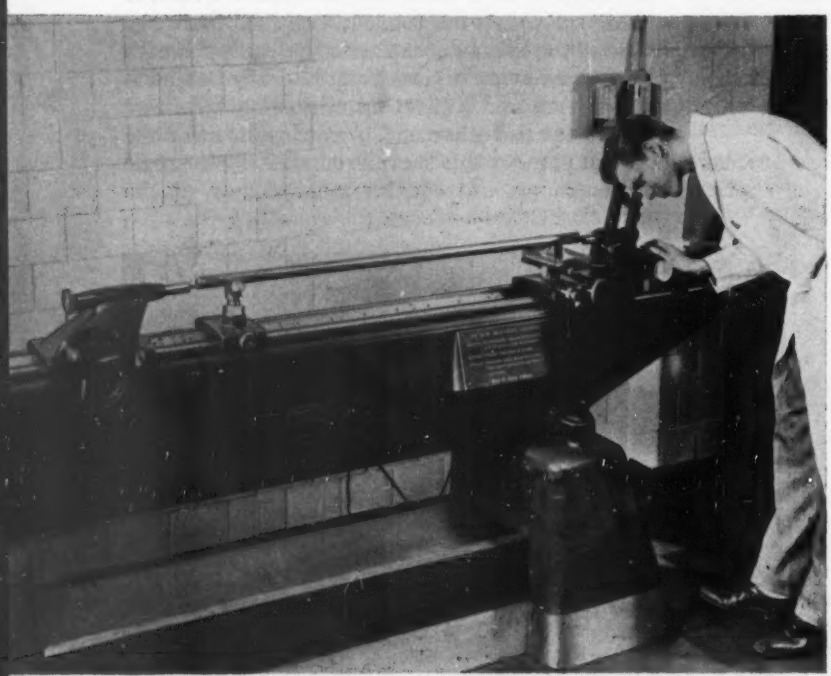


Fig. 4. The standard being checked is supported by contact points on the machine ways as the reading is taken through the optimeter. The tailstock adjusts itself to compensate for headstock error.

Fig. 5. This universal bench type machine measures length, width, and depth. It is unique in that it can be adapted to determine the pitch diameter of internal as well as external threads.

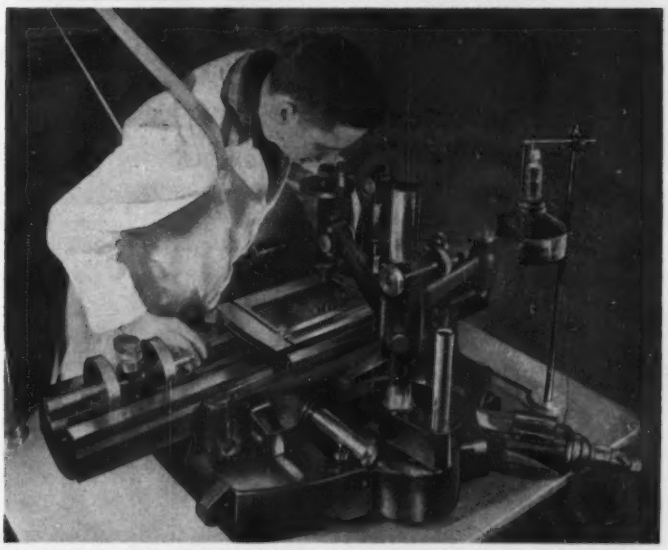


Fig. 6. The inherent ability of this optical instrument to measure objects irregular in shape makes it a vital piece of equipment of the gage laboratory.

Fig. 7. The dial setting of this Graham-Mintel electronic comparator checks precision gage-blocks. It compensates for any error in laboratory gages reported by the National Bureau of Standards.

Fig. 8. Having a capacity for objects up to 6 inches long and 4 inches wide, this projector can be used both as a comparator and as a measuring machine.

measurements between 0 and 80 inches, and inside measurements between 4 and 76 inches.

Bench type universal measuring equipment is shown in Figs. 5 and 6. The Sip machine, Fig. 5, measures all three dimensions—length, width, and depth. Scales on the machine are graduated in 0.00005 inch, and angle measurements can be read directly to within 1 minute. Available attachments measure pitch diameter and lead of internal as well as external threads.

The Zeiss machine, Fig. 6, has comparable accuracy. It is ideal for measuring objects of irregular shape, and has a lineal measuring capacity of 8 inches in length and 4 inches in width. Angle range is from 0 to 360 degrees. In the illustration, the inspector is measuring the contour of a cone forming-tool profile gage. The strap seen supporting the inspector's shoulder serves to reduce fatigue.

A Graham-Mintel electronic comparator, measuring to 0.000001 inch, can be seen in Fig. 7. This instrument is used to check precision gage-block sets against laboratory masters. The comparator is adjusted to the laboratory block, then replaced by the block to be checked, and the variation is recorded. The serrated surface of the anvil of the comparator reduces the amount of friction with the highly lapped surfaces of the blocks. Periodically, the laboratory masters are sent to the National Bureau of Standards for examination. Any error reported is compensated for in adjusting the comparator.

A Bausch & Lomb projector is shown in Fig. 8. It is accurate to within 0.0001-inch lineal measurement and 1-minute angle measurement. When used as a comparator, the work can be viewed against a scale-size chart. This is done in the illustrated application, where a forming tool is being checked. This projector can also be used as an actual measuring machine. Measurements are read on 0.0001-inch micrometers mounted on the cross-slides of the machine.

Another type of comparator found in the laboratory is the Pratt & Whitney "Electrolimit" gage, Fig. 9. Calibrated to 0.00002 inch, this machine can accommodate work for external measurements to 8 inches and internal measurements to 10 inches. The operation shown in progress consists of checking a bearing cone-bore ring gage for roundness, straightness, bell-mouth, and size. The gage is marked to the nearest 0.000025

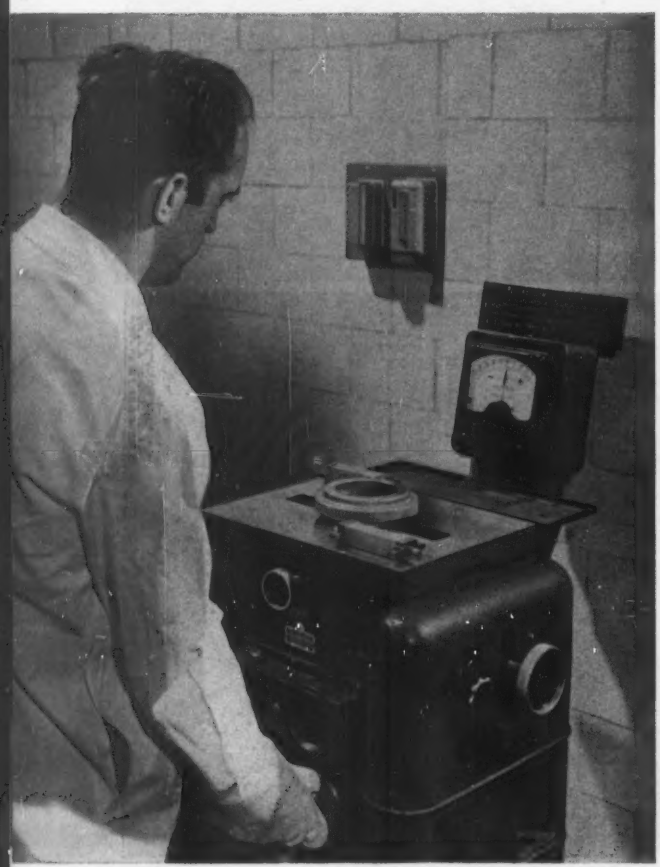


Fig. 9. This Pratt & Whitney "Electrolimit" gage is calibrated to 0.00002 inch.

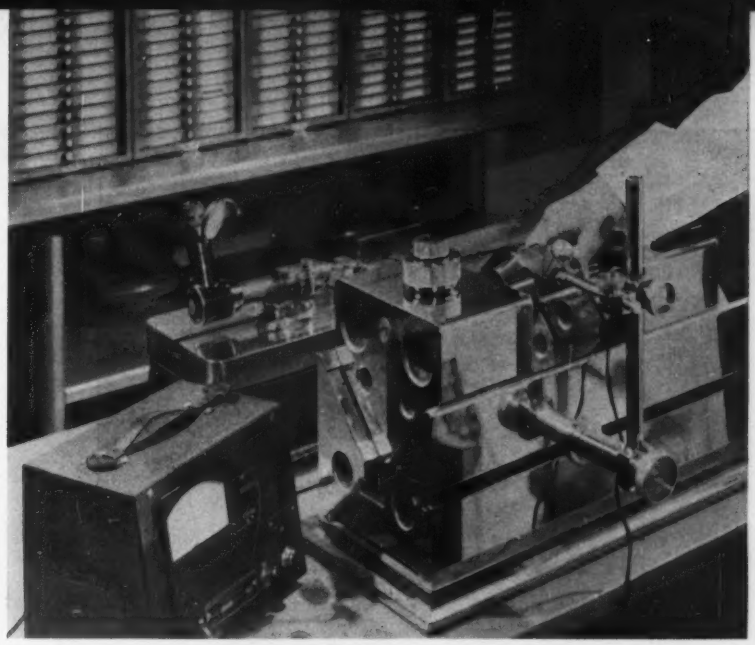


Fig. 10. These centers are made of Graph-Mo steel. Many measuring devices, gages, and tools designed and used by the company are made of this electric furnace product.

inch, precision blocks are built up to the required size, and the comparator is set at zero. Then, the gage is substituted for the ring and a reading is taken. Ordinarily, two sets of precision blocks are used to assure extreme accuracy.

Unable to procure precision centers of the accuracy required, the gage laboratory designed and built its own. These centers, Fig. 10, are elements of a V-block assembly, and are in line to within 0.0001 inch. Plug gages are held on an arbor that is set up between the two centers and rotated manually. A Graham-Mintel comparator shows the amount of deviation from roundness and the amount of face run-out.

Operations like inspecting bearing roller cage pocket spacing are performed on the Vinco checking dividing head shown in Fig. 11. This instrument, which is gearless, is graduated in seconds, in an angle range of 0 to 360 degrees. After the cage is trued up on the magnetic block attached to the faceplate, the contact point of an electronic comparator is positioned at one roller pocket and

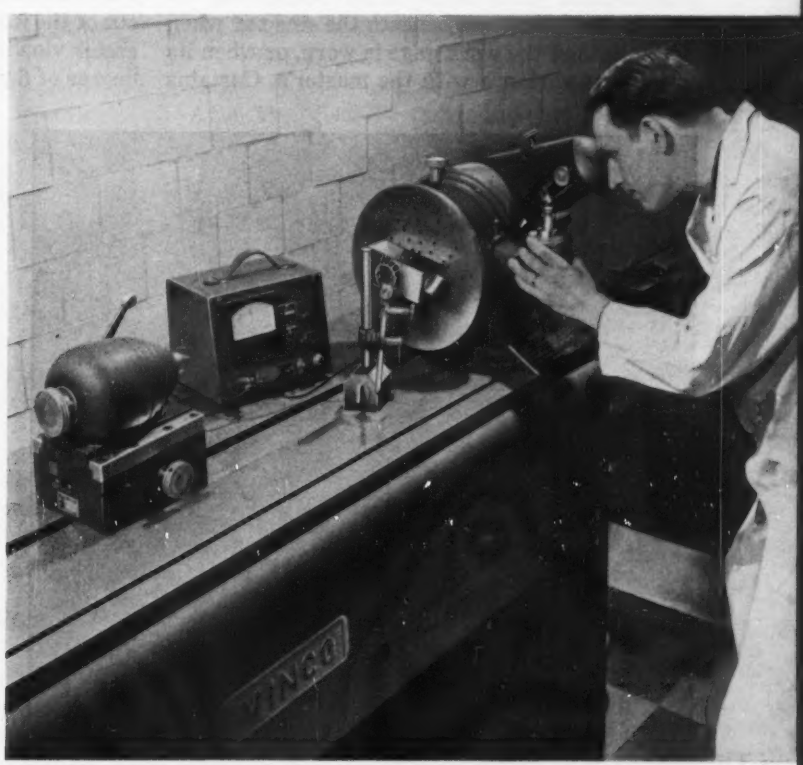


Fig. 11. Absence of gears in the design of this dividing head produces extremely accurate spacing.

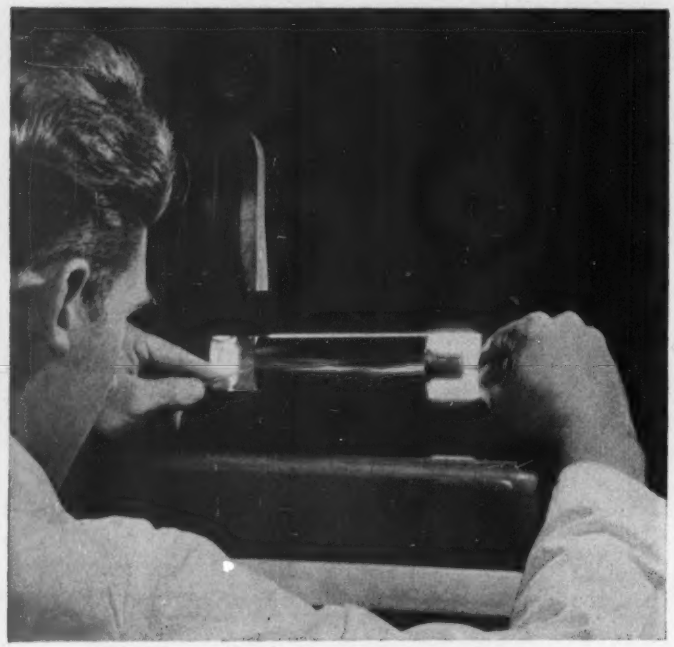


Fig. 12. Diffused light coming from behind the sine bar is utilized to compare tapers with a master in a darkened booth.

the faceplate is indexed the correct angle distance. The adjacent pocket is then checked. Extremely accurate results are obtained with the head.

Sine-bar inspections of tapered work gages are made by comparing them to reference masters. The illustration in Fig. 12 shows a Taft-Peirce sine bar in use. A ray of light from an illuminated ground-glass panel immediately behind the inspection table appears beneath the sine bar when the surface of the work gage is worn, or when its taper is at variance with the master's. Curtains around the booths in which these inspections are performed cut out reflections.

In Fig. 13, the flatness of a stainless-steel mirror used in angle checking devices is being inspected with Van Keuren optical measuring equipment. A 6-inch diameter optical flat, accurate to within 0.000002 inch, is positioned over the mirror. Monochromatic light takes the color out of the interference bands, darkening them for easier viewing. Curves in the bands indicate the degree of flatness of the surface of the mirror.

Fig. 13. Flatness of the work is determined by the curvature of the bands in the optical flat in this Van Keuren measuring equipment.

Fig. 14. Movement of the stylus back and forth over the work is translated and recorded by the dials and graph paper.

The Brush analyzer, Fig. 14, is determining the surface finish of a bearing roller master. A diamond stylus carried behind a steel ball moves laterally 1/8 inch. Movement of the stylus is recorded on the meter shown in the center and on the graph paper on the instrument at the left. Both register 0.000001-inch variations. The meter on the right is used to calibrate the gage.

X-Ray Gage Controls Rolling Mill Equipment

CONVENTIONAL rolling of copper-alloy strip consists of spot-checking strip with a hand micrometer and setting rolls by rule-of-thumb methods based on the operator's experience. These methods are still practiced in many rolling operations, although they are crude when compared with the degree of quality control that can be obtained with modern electronic equipment, such as X-ray gages.

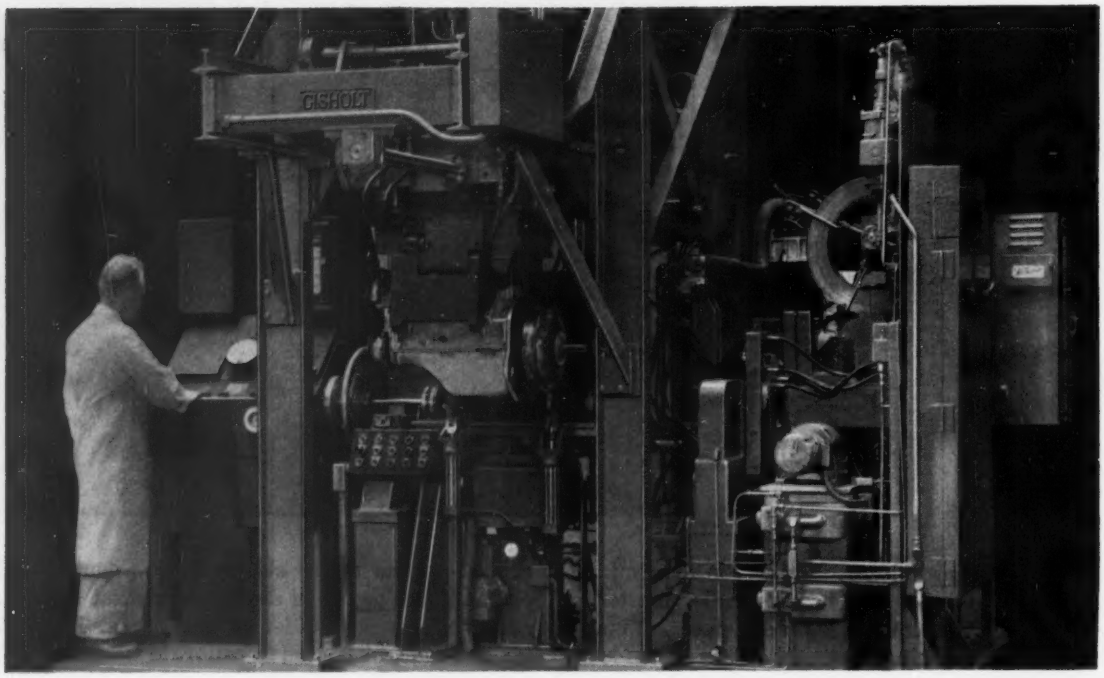
The thickness of copper-alloy strip is controlled by X-ray gages in the rolling mills of the Chase Brass & Copper Co., Inc., a subsidiary of the Kennecott Copper Corporation. The original X-ray gages were installed several years ago in a Chase mill in Cleveland, Ohio, and are still in use. Very little maintenance work has been required to keep them in continuous use. There have been no X-ray tube burnouts, and occasional replacement of an electron tube has been performed by electrical maintenance men without difficulty.

The gages, operating on 155-volt alternating-current lines, contain a compact high voltage source and an X-ray tube, both shielded so they are entirely safe. The source unit is placed about 8 inches beneath the strip at a point within 2 feet of the rolls. A small hole in the top allows a tiny X-ray beam to pass upward through the moving strip. When the mill is not operating, this aperture is automatically blocked with a shield guard.

After the X-ray beam has passed through the strip, with some of its energy absorbed by the metal, it passes into a small pick-up device that is mounted over the strip directly above the aperture in the source unit. The pick-up unit converts the X-ray energy into electrical energy, which is amplified and fed into a zero-center meter calibrated to indicate deviation from the nominal gage. Maximum readings indicate a variation of plus or minus one-tenth of the strip thickness. The scale is graduated so that readings of as little as 0.000050 inch can be obtained on the thinnest strip rolled.

When variations from the known standard swing more than the prescribed limit for which the operator's controls are set, the signal actuates circuits built into the gage that control screw-down adjustments to exactly compensate for thickness variations in the incoming strip. The signal that actuates this meter can also be fed into a continuous tape recorder of the stylus type so that a permanent record of all strip rolled can be retained for future reference.

Handling Automotive Engines



DURING the last few years, the use of balancing machines in automobile production has increased greatly. Realizing that the measuring and locating of unbalance in rotating bodies was only half the job, the Gisholt Machine Co. has designed and built unbalance correction devices and machines to work in conjunction with the balancing machines on a semi-automatic or automatic cycle. Recently another significant advance was made—a balancing machine with correction facilities and automatic transfer equipment for the balancing of automobile engine assemblies. The new machine can be seen in the heading illustration with an engine being lowered into position for balancing.

This equipment accepts an assembled engine, together with the torque converter, and measures and locates by electronic means the unbalance in the running engine. The machine corrects the unbalance to a production tolerance of 0.5 ounce-inch, and the accuracy to which each engine is balanced is graphically recorded. The engines are automatically loaded into and unloaded from the balancing machine by overhead transfer equipment. The purpose of the transfer equipment is to move unbalanced engines from an incoming conveyor line to the machine, and to transfer balanced engines from the machine to an outgoing conveyor line. These conveyor lines are shunted off and back onto the engine assembly conveyor.

The transfer equipment consists of a track *A* and a carriage *B*, Fig. 1, carrying two pairs of hydraulically powered hooks. Hooks *C* handle the unbalanced motors and hooks *D*, the balanced motors. The carriage is moved along the track by means of a lead-screw that is driven by direct-current motor. The motor is equipped with an Amplidyne which automatically controls the accelerating, traversing, decelerating, stopping, and positioning of the carriage. Cams and limit switches are employed to initiate steps in the control of the transfer equipment. The hooks are moved up and down, controlled by solenoid-operated valves, and are opened and closed hydraulically. The necessary hydraulic pressure is provided by a pump mounted on, and moving with, the carriage. The transfer equipment moves unbalanced engines into a balancing machine cradle, Fig. 2, which is freely supported to permit movement only in a horizontal plane.

When an engine has been balanced, a new cycle is initiated by an operator pressing the "load" button. At this time, hooks *C* are holding an unbalanced engine and hooks *D*, which were in position to grip the balanced engine, close around the balanced engine and lift it out of the balancing machine cradle. The carriage

Automatically During Balancing

Another important advance in automotive engine balancing is the automatic transfer of engines in a new dynamic balancing machine. Three machines can balance 100 V-8 engines per hour—measuring, locating, correcting, and inspecting the unbalance to within 0.5 ounce-inch

By ARNOLD B. PEDERSEN
Balancing Machine Division
Gisholt Machine Co.
Madison, Wis.

then traverses to the rear to bring the unbalanced engine over the cradle.

The engine is then lowered onto a loading jack, *E* in Fig. 2, which is mounted within the cradle to protect it from the shock of loading and unloading. Then the hooks open, to release the engine, and are raised to clear the engine. The carriage again travels to the rear until the balanced engine is over the outgoing conveyor. If there is an empty fixture in proper position on the outgoing conveyor, the balanced engine is lowered into the fixture, the hooks open to release the engine, and are then raised to clear the engine. As soon as the hooks are clear, the outgoing conveyor is moved to bring another empty fixture into position.

When the hooks are clear of the balanced engine, the carriage is traversed at high speed back toward the incoming conveyor line. At this point, the open hooks *C* descend, provided that an unbalanced engine is in position on the incoming conveyor. The hooks close and lift the engine off the incoming conveyor, and the carriage moves to the rear until hooks *D* are over the engine in the balancing machine, as seen in Fig. 3. The open hooks *D* are then lowered, and remain in this position until the operator again depresses the "load" button. The unbalanced engine in hooks *C* is now in such a position as to make it possible for the incoming conveyor to advance another balanced engine to the desired position.

As soon as an unbalanced engine assembly has been deposited in the loading jack within the balancer cradle, the operator couples the driving adapter to the belt pulley end of the

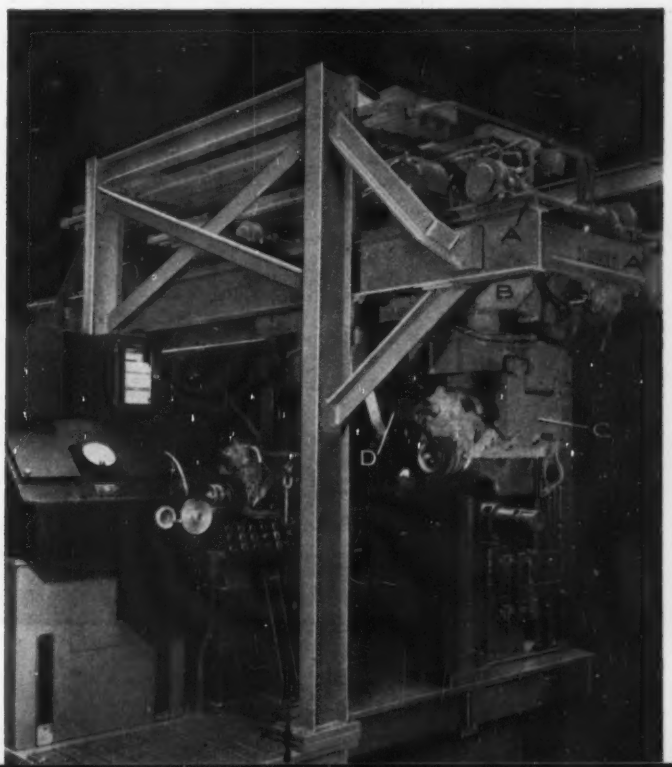


Fig. 1. Transfer equipment on dynamic balancing machine consists of a track *A* and a carriage *B* carrying two pairs of hydraulically powered hooks, *C* and *D*.

Fig. 2. Balancer cradle is freely supported to permit movement only in a horizontal plane. The engine rests on a V-block *F* and locating pins *G*. Jack *E* is employed during loading and unloading.

engine. The engine is automatically lowered into and clamped to the cradle by hydraulic means, thus making the engine part of the freely suspended cradle. The engine is supported on a V-block *F* at the chain-case cover end and on locating pins *G* as shown in Fig. 2 at the rear end of the cylinder block. The cradle is hydraulically locked against movement while it is being loaded and unloaded.

The operator now pushes a "start" button that causes the engine to be rotated at 400 R.P.M. This speed is below that at which the torque converter "locks in," and the driven parts of the torque converter are held against rotation by an arbor inserted on the engine assembly line. These driven parts of the torque converter have no mechanical connection with the rotating element being balanced, and therefore have no effect on the unbalance indications. The amount and location of unbalance in the torque converter are read, and the angle of the unbalance is then set on a "dummy" dial. The amount of unbalance is automatically recorded within a welder "brain-memory" unit.

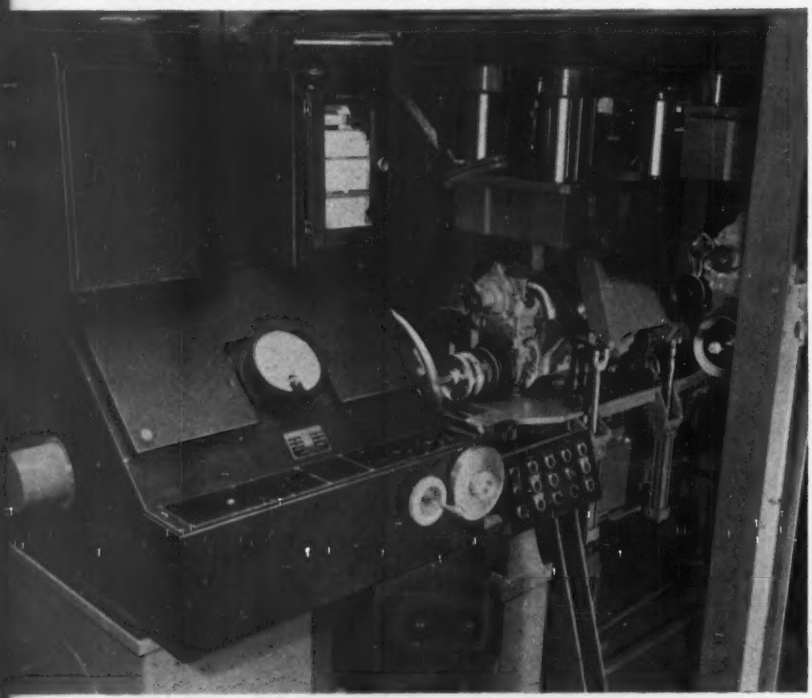


Fig. 3. Assembled automotive engine is shown in the balancing machine cradle, with conveyor hooks in position to remove the engine after balancing.

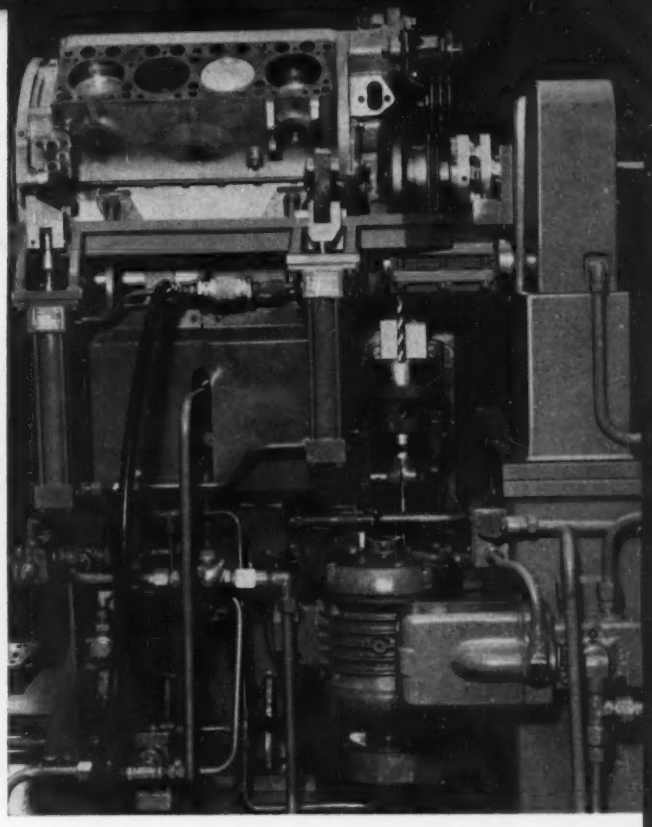


Fig. 4. Close-up view showing the drill spindle employed for correcting the unbalance by removing the required amount of metal from a predetermined location on the vibration damper of the assembled engine.

The amount and location of unbalance in the vibration damper are now determined, and the amount of drill depth reading is recorded in the drill brain memory unit. The operator stops the balancer, indexes the rotating assembly to a position corresponding to the location of the unbalance in the vibration damper, and presses the "drill" button. The correction is made in the vibration damper by drilling, as shown in Fig. 4.

Pressing of the "drill" button also initiates the preparatory events for the welding cycle. First, the correction strip is metered off from the reel, as seen in Fig. 5, with the strip being fed through a series of rollers, which first straighten the strip and then form it to fit the radius of the torque converter. When the exact length of the strip required for corrections has been metered off, a punch shears this length from the strip. As the punch comes down, a set of plier-like fingers *H*, Fig. 6, close about the mid-point of the length of strip *J*, and carry the strip to jaws over the lower electrode *K* of a spot welder. The fingers then release the strip and rise to allow the welding head to rotate 90 degrees to the welding position on the torque converter, Fig. 7.

When the correction drilling is complete and the strip in the welder is in proper position, a green light goes on to indicate to the operator that the welding head is ready to operate. The engine assembly is rotated to the angle corresponding with the unbalance location in the torque converter, to bring the light spot of the torque converter in line with the welding fingers. The operator presses the "weld" button to bring the welding electrodes in to spot-weld the strip onto the torque converter torus.

Strips less than 1 1/2 inches long are attached with a single weld. If the correction strip is longer than 1 1/2 inches, three welds are made, one at the mid-point of the strip and the other welds 1/2 inch from each end of the strip. This keeps the ends of the strip from bending outward due to centrifugal force produced by the high rotational speed of the engine. After the welding has been completed, the welding

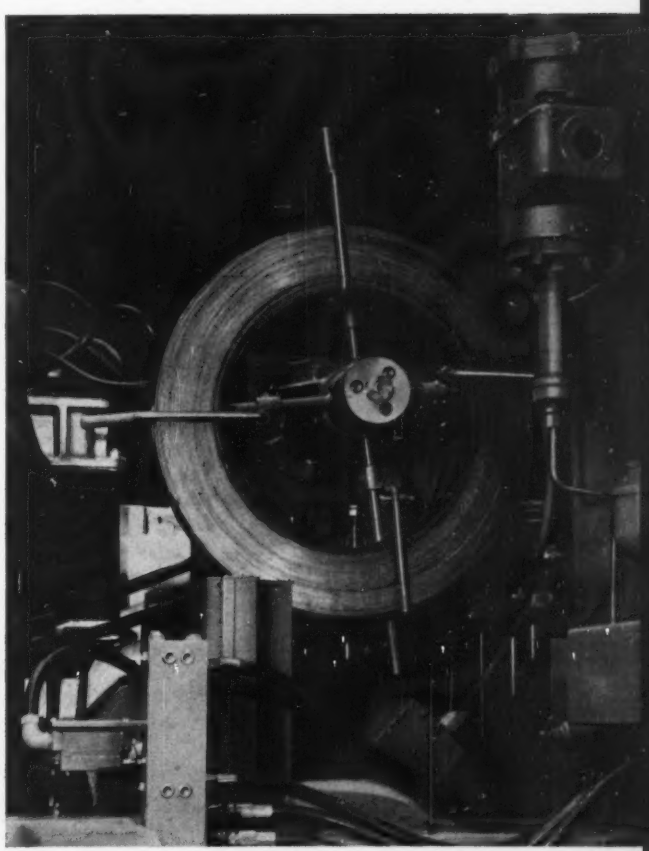


Fig. 5. Required length of steel correction strip is metered from reel, the strip being fed through a series of rollers which first straighten and then form the strip, to fit the torque converter.

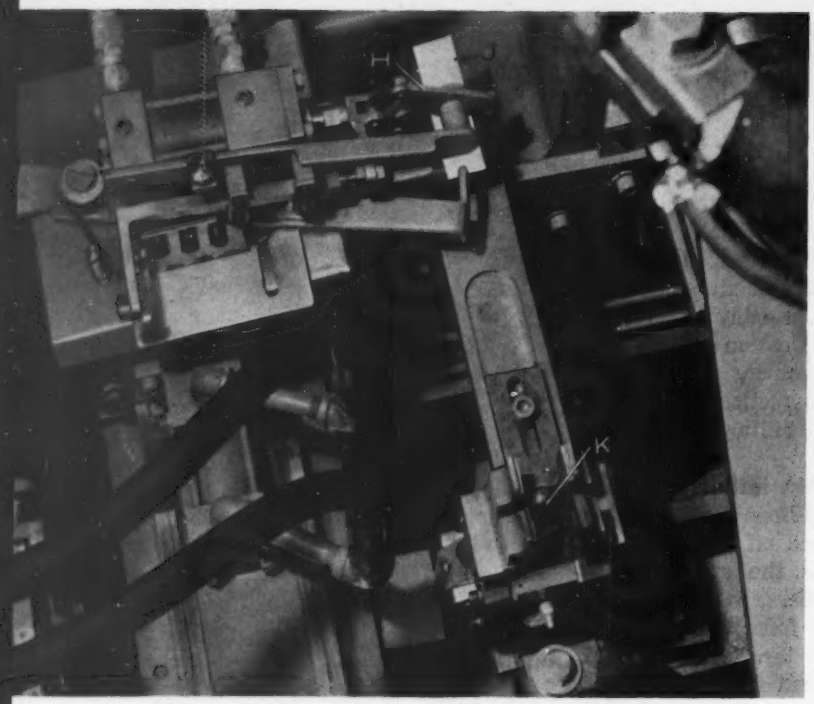


Fig. 6. Fingers *H* carry the sheared-to-length correction strip *J* to jaws over the lower electrode *K* of a spot welder.

head is again swung through an angle of 90 degrees to return to its starting position, where it waits to be loaded with the correction strip required for the next engine.

If no correction is required in the vibration damper, no hole will be drilled should the operator press the "drill" button. If no correction is required in the torque converter, the strip feed mechanism will remain inoperative, and if the operator should press the "weld" button, the welding head will pass no current.

After the corrections for balance have been made, the operator starts the machine to determine whether the balance is within the limits set for the job. A permanent record of the unbalance remaining in the engine is provided by a graphic electronic recorder (Fig. 3). The operator throws a switch to the "inspect" position to make the instrument record. A window is provided so that the operator can mark the serial number of the engine on the graphic record. In this way, the manufacturer is provided with a permanent record of the accuracy of each engine. The operator then removes the driving adapter from the engine. This action causes the engine to be unclamped, and the engine assembly is raised above the balancer cradle by the loading jack into a position suitable for a new cycle to be initiated.

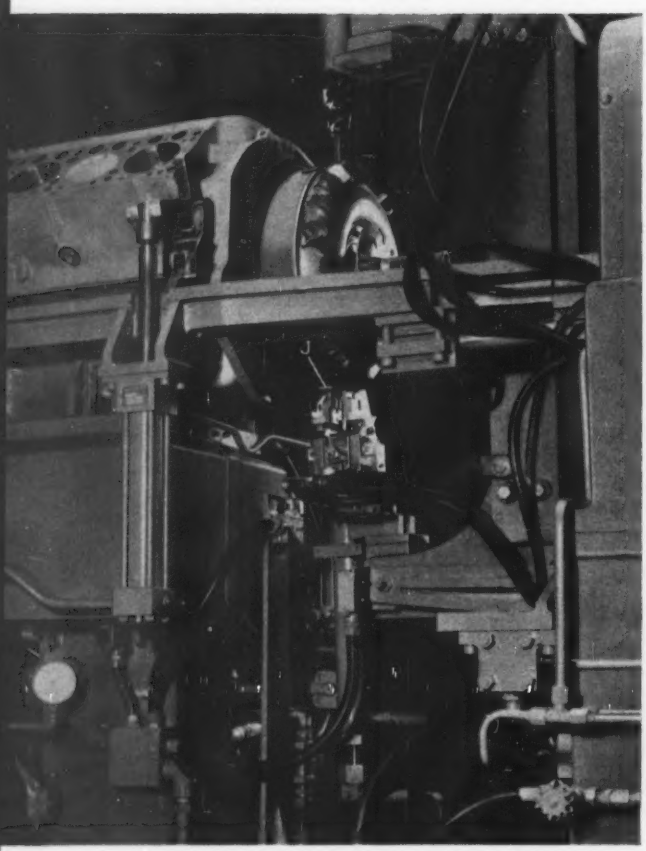


Fig. 7. Welding head has been rotated through an angle of 90 degrees into position for welding the correction strip *J* to the torque converter.

Half-Revolution Geneva Mechanism

By HAIM MURRO

THREE slots is the minimum number that can be used in the conventional type of Geneva mechanism. Or in terms of motion, 120 degrees is the greatest possible angle of rotation of the driven member for each revolution of the driver. It is for this reason that many designers resort to other mechanisms when 180 degrees of intermittent rotation is required of the driven member. For some applications, however, it is possible to use a modified form of the conventional Geneva mechanism, of the type shown in Fig. 1, so that the necessary half-revolution is obtained.

In Fig. 1, driver *A* is a circular disc to which pin *c* is bolted. For better performance a roller on a sleeve or an anti-friction bearing, instead of the pin which is shown for simplicity, should be used. A segment *d* on driver *A* serves to lock wheel *B* in position during the idle period of the cycle.

Wheel *B* has two V-shaped slots. When the wheel is in the idle position, the center lines of the slots are tangent to the circular path of the roller, as shown. Mounted on wheel *B* are two spring-loaded dogs *e*, one in each of the V-slots. These dogs have beveled tops, and, under pressure of driving pin *c*, are forced into a recess in the V-groove so that the pin may pass over them.

When driver *A* rotates, pin *c* enters the slot which lies in its path, and begins to turn wheel *B*. Also, at this point, the segment *d* passes the center line, leaving the wheel free to rotate as the pin continues to enter the slot. Approaching the cen-

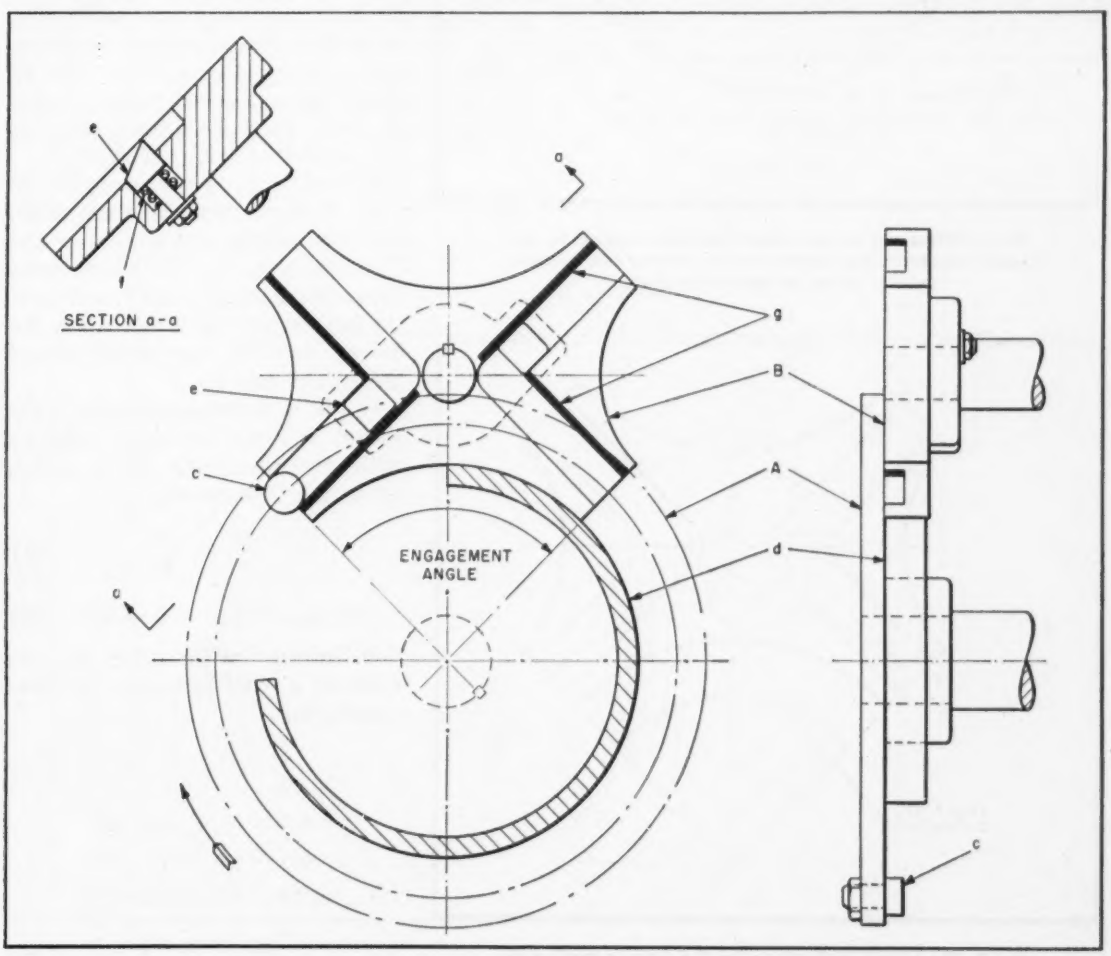


Fig. 1. Diagram of half-revolution Geneva mechanism showing driving pin about to enter slot in driven member.

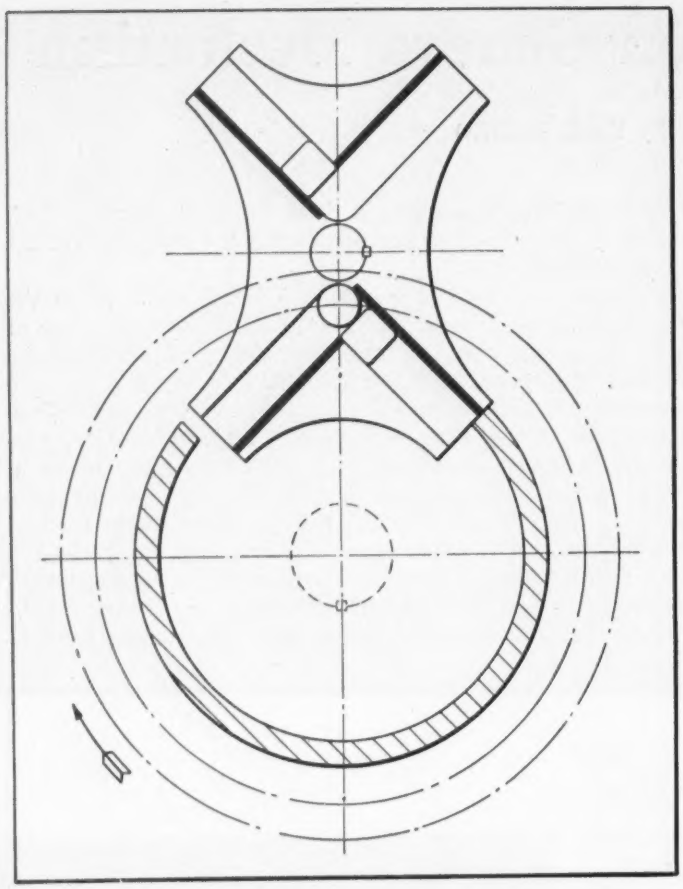


Fig. 2. When the driven wheel has been rotated 90 degrees, as shown, the driving pin has passed over the dog and is at the bottom of the V-slot.

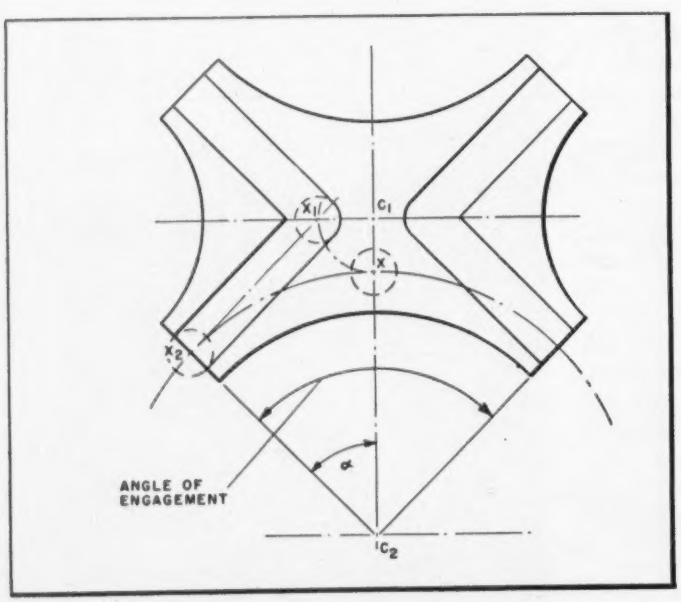


Fig. 3. The correct proportions for the Geneva mechanism involve simple geometric considerations.

ter of the V-slot, the pin passes over dog *e*, pressing it down as it passes. In Fig. 2 is shown the position of the mechanism when pin *c* has reached the bottom of the V-slot. In this position the pin has passed over the dog and the dog has been returned to its initial extended position by the force exerted through spring *f*, shown in section a–a, Fig. 1.

When the pin is rotated further, it presses against the vertical side of the dog, which now forms an extension of the side of the V-slot. In practice, the sides of the slot exposed to the pressure of the pin are lined with a hard material which can be replaced when it becomes worn. These linings are shown as heavy lines marked *g* in Fig. 1.

Lay-Out of Mechanism

As shown in Fig. 3, the lay-out of the mechanism may be considered in terms of a simple problem in geometry, namely: Given the centers of the driving and driven wheels, C_1 and C_2, find a point X on the center line C_1C_2 such that $C_1X_1 = C_1X$, $C_2X_2 = C_2X$, and X_1X_2 is perpendicular to C_2X_2. If these conditions are satisfied, the driving pin will enter the V-slot tangentially, which is the most favorable condition, and it will be at the bottom of the V-slot when the driven member has been turned through 90 degrees.

In Fig. 4, the basic geometric form shown in Fig. 3 has been redrawn with two auxiliary lines added. From the illustration,

$$\frac{d}{a} = \frac{c}{a_1} \qquad (1)$$

$$c = a_2 - b = a - a_1 - b \qquad (2)$$

Substituting in Equation (1) the value of c from Equation (2), and simplifying,

$$\frac{d}{a} = \frac{a - a_1 - b}{a_1}$$

$$a_1 d = a^2 - a a_1 - ab$$

$$a_1 d + a a_1 = a^2 - ab$$

$$a_1 (a + d) = a (a - b)$$

$$\frac{a_1}{a} = \frac{a - b}{a + d} \qquad (3)$$

This last equation suggests the graphical method shown in Fig. 5 as a means of finding length a_1 in Fig. 4. Instead of this graphical solution, however, an analytical method may be used: Since $b = a \cos \alpha$ and $d = a \sin \alpha$, these values for b and d may be substituted in Equation (3) to obtain Equation (4):

$$\frac{a_1}{a} = \frac{1 - \cos \alpha}{1 + \sin \alpha} \qquad (4)$$

Table 1 is a tabulation of $\frac{1 - \cos \alpha}{1 + \sin \alpha}$ for use in Equation (4), and covers angles from 30 to 60 degrees. From general design considerations, an angle $\alpha = 45$ degrees is best.

Angular Displacement, Velocity, and Acceleration Characteristics

The angular displacement, angular velocity, and angular acceleration of modified Geneva mechanisms having 60-, 90-, and 120-degree engagement angles are shown in Figs. 6, 7, and 8. The velocity and acceleration curves for each of these mechanisms are based on the driving member having a uniform angular velocity of 1 ra-

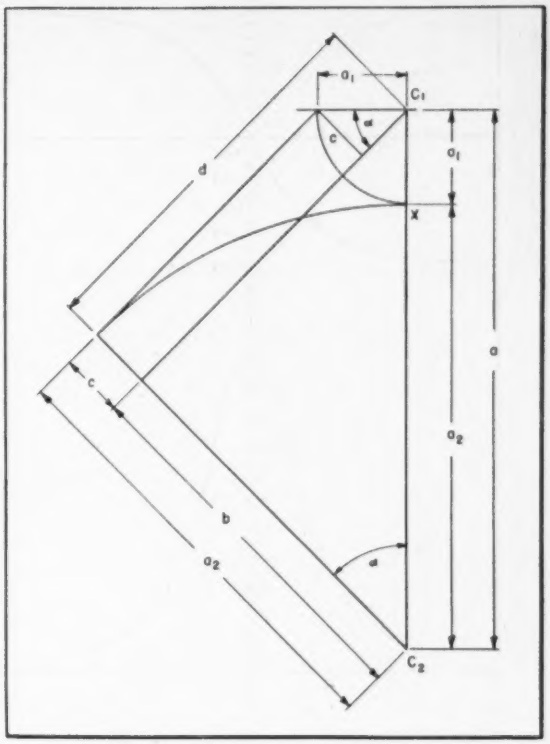


Fig. 4. Simplified lay-out of the mechanism illustrated in Fig. 1, which is employed to determine its proportions

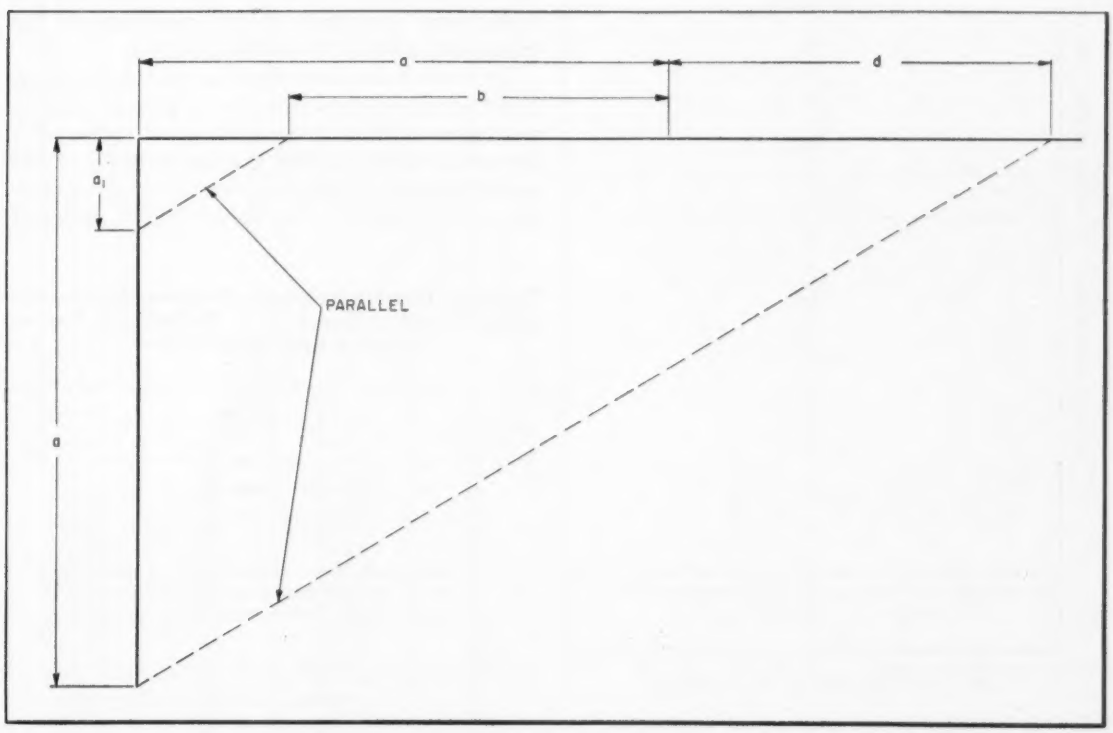


Fig. 5. Graphical method of determining length a_1 shown in Fig. 4

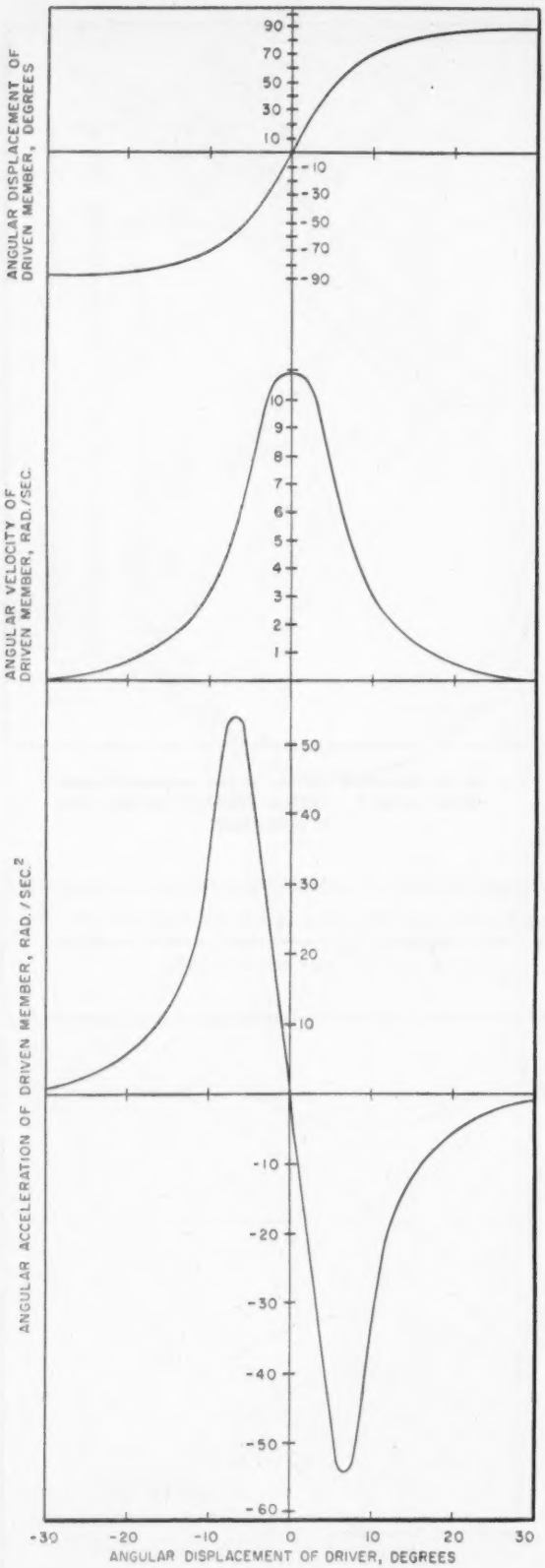

ANGULAR DISPLACEMENT OF DRIVEN MEMBER, DEGREES
ANGULAR VELOCITY OF DRIVEN MEMBER, RAD./SEC.
ANGULAR ACCELERATION OF DRIVEN MEMBER, RAD./SEC.²
ANGULAR DISPLACEMENT OF DRIVER, DEGREES

Fig. 6. Displacement, velocity, and acceleration diagrams for a half-revolution Geneva mechanism having an engagement angle of 60 degrees

Table 1. Values of $(1 - \cos \alpha)/(1 + \sin \alpha)$ Corresponding to Various Values of α

α, Degrees	$\frac{1 - \cos \alpha}{1 + \sin \alpha}$	α, Degrees	$\frac{1 - \cos \alpha}{1 + \sin \alpha}$
30	0.08931	46	0.17759
31	0.09427	47	0.18367
32	0.09932	48	0.18981
33	0.10445	49	0.19601
34	0.10964	50	0.20227
35	0.11493	51	0.20858
36	0.12028	52	0.21495
37	0.12571	53	0.22138
38	0.13121	54	0.22786
39	0.13677	55	0.23441
40	0.14242	56	0.24101
41	0.14812	57	0.24766
42	0.15389	58	0.25436
43	0.15972	59	0.26113
44	0.16561	60	0.26795
45	0.17157	..	.....

dian per second (9.55 R.P.M.). The velocity curves shown were obtained by graphical differentiation of the displacement curves, and the acceleration curves by graphical differentiation of the velocity curves, since the equations involved in an analytical solution were not easy to handle.

The displacement curves have a slight "bend" near the center position which is responsible for two maximums and a minimum in the velocity curves near the center position. The "hump" in the velocity curves decreases with the engagement angle, and disappears entirely when the latter is 60 degrees. In practice, this change in velocity occurring over a very short portion of the cycle will cause some roughness in the operation of the mechanism around the center position.

The curves also show that the maximum velocity of the driven member, for angles of engagement greater than 60 degrees, is not achieved at the center position. The angular velocity in the center position equals a_2/a_1 which value is $[(1 + \sin \alpha)/(1 - \cos \alpha)] - 1$. Table 2 gives values of

Table 2. Angular Velocity of Driven Member in Center Position Based on 1 Radian per Second Angular Velocity of Driver

Angle of Engagement, Degrees	Velocity, Radians per Second	Angle of Engagement, Degrees	Velocity, Radians per Second
60	10.9695	92	4.6309
62	9.6078	94	4.4445
64	9.0684	96	4.2684
66	8.5739	98	4.1017
68	8.1207	100	3.9438
70	7.7009	102	3.7943
72	7.3139	104	3.6522
74	6.9548	106	3.5171
76	6.6213	108	3.3886
78	6.3115	110	3.2660
80	6.0214	112	3.1492
82	5.7512	114	3.0377
84	5.4981	116	2.9314
86	5.2609	118	2.8295
88	5.0382	120	2.7320
90	4.8285	...	.....

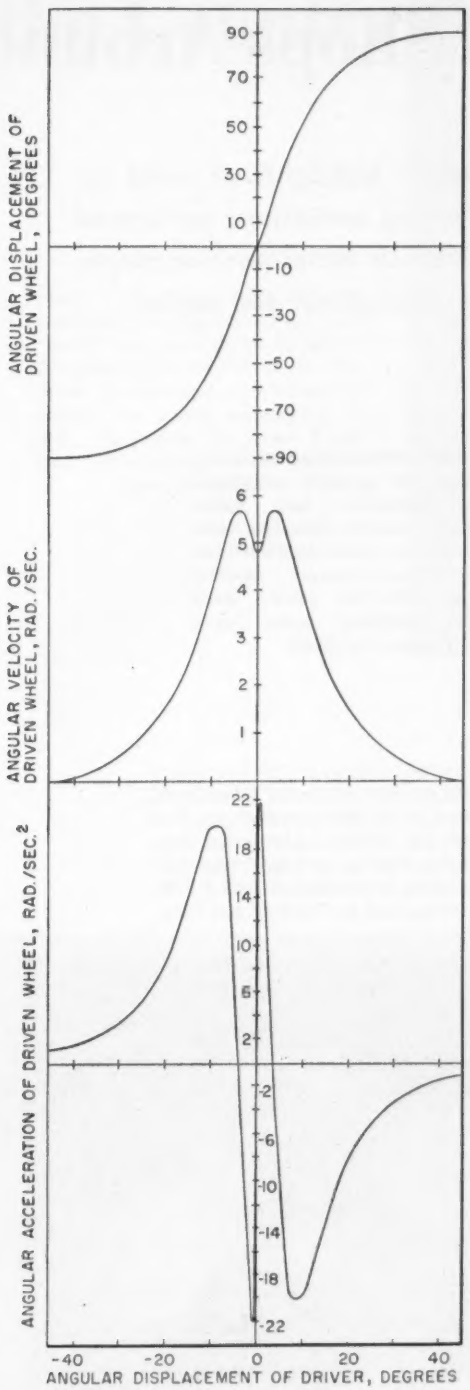


Fig. 7. Displacement, velocity, and acceleration diagrams for a half-revolution Geneva mechanism having a 90-degree engagement angle

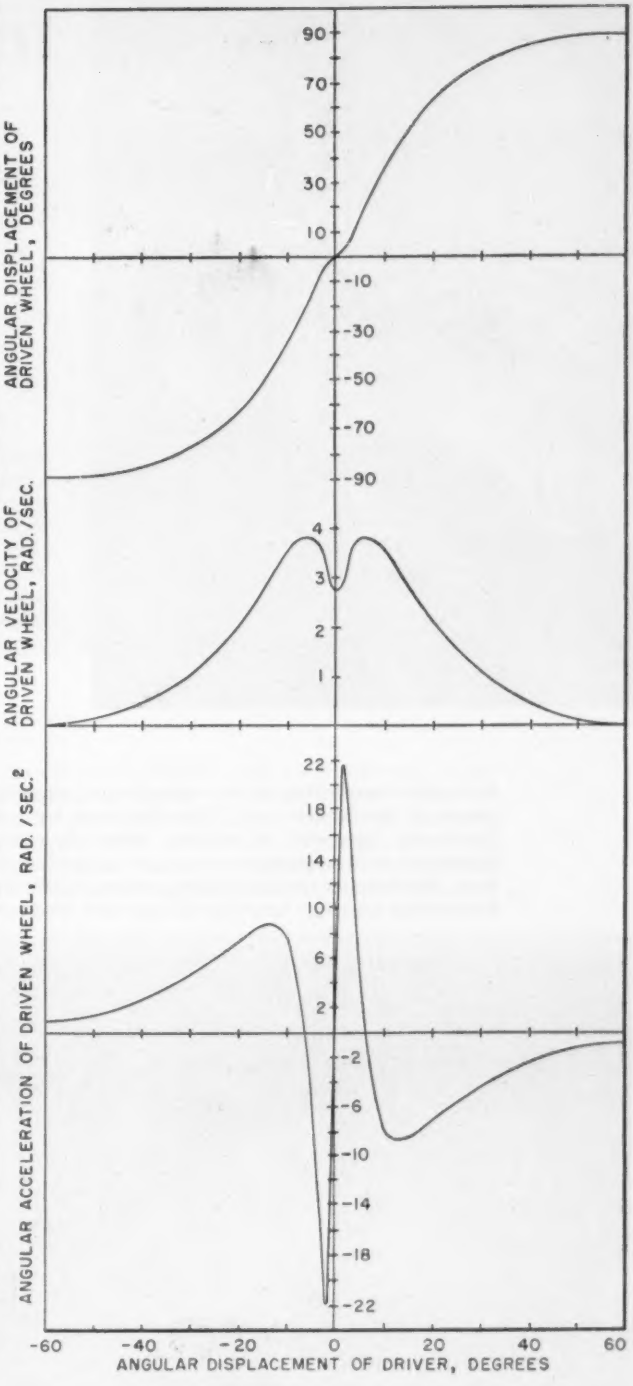


Fig. 8. Displacement, velocity, and acceleration diagrams for a half-revolution Geneva mechanism having an engagement angle of 120 degrees

these velocities for a number of engagement angles from 60 to 120 degrees.

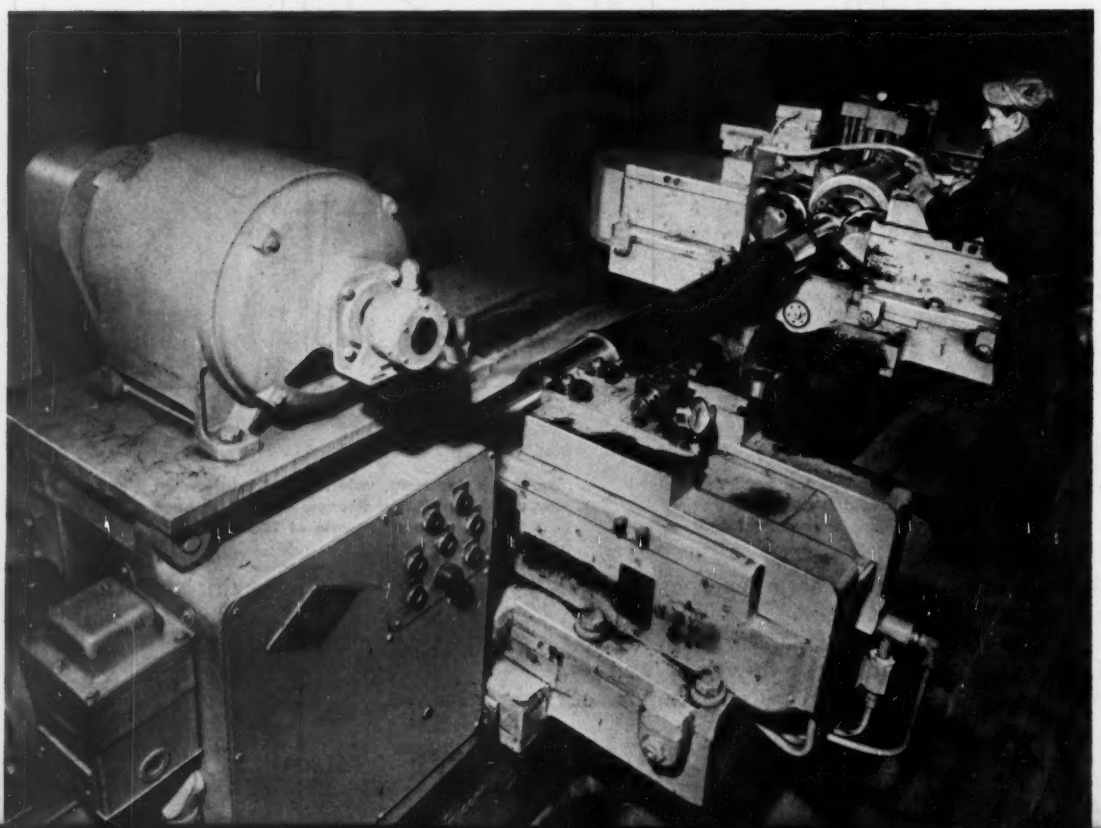
The velocity and acceleration curves in Figs. 6, 7, and 8 may be used to obtain the velocity and acceleration values for N revolutions per minute of the driving member by multiplying the ordinates on these curves by $\left(\frac{\pi N}{30}\right)$ and $\left(\frac{\pi N}{30}\right)^2$, respectively.

In Shops Around

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation

Both sides of flat metal carpenter squares are ground simultaneously between two Behr-Manning coated abrasive belts that move in opposite directions over rubber-rimmed contact wheels. With this set-up, production finishing rates have been doubled.

Automatic burnishing of car-wheel axle journals is performed in the Glenwood shops of the Baltimore & Ohio Railroad by means of a Niles end-drive, hydraulically operated burnishing lathe developed by Baldwin-Lima-Hamilton Corporation. Predetermined pressure is applied hydraulically, and automatically held constant on the burnishing wheels while the axle is rotated at 220 R.P.M. Burnishing time has been cut 25 per cent, and ten axles can be finished per hour.



the Country

Electronic paint spraying of metal containers is performed with an "Ionic" gun developed by Scientific Electric, Garfield, N. J. The paint is charged electronically within the spray apparatus itself, producing an even finish and penetrating into crevices and cavities.

Rods are finish-drawn, cut to length, straightened, and polished—all in one continuous operation—on "four-in-one" Schumag machines now in operation at the American Brass Co.'s mill at Torrington, Conn. The new machines produce finished rod in diameters from 3/32 to 7/8 inch, at speeds up to 140 feet per minute. These operations were previously performed on separate machines—draw-benches, straighteners, saws, and tumbling barrels.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Reverse-Polarity Mild-Steel Welding Electrode

A general-purpose mild-steel welding electrode, designed for optimum flexibility of application with reduced operator effort, has been marketed by the General Electric Co., Schenectady 5, N. Y. Designated as G-E Type W-610-A, the electrode is a direct-current reverse-polarity rod meeting AWS Class E-6010 specifications.

It is said that the electrode facilitates butt, fillet, lap-joint, and edge welding in all positions. Its ability to take high currents, together with freedom from reaction pitting, fingernailing, spattering, and blistering of the coating, assures a high ratio of inches-of-welding to inches-of-electrode used. Typical applications include the welding of pipe and steam lines, ship structural frames, bridges, and unclad pressure vessels.

Aluminum Bronze Wear Strip With Machinable Steel Base

The availability of OK wear strips has recently been announced by the Ohio Knife Co., Dreman Ave., Cincinnati 23, Ohio. The strips have a wearing surface of aluminum bronze with a machinable steel base. A special method of welding is used to join the two metals. A large assortment of sizes is available. All surfaces are ground to close tolerances.

Soluble Oil for Use in Metal-Working Operations

A soluble oil for use as a coolant-lubricant on practically all types of metal-cutting, grinding, and forming operations has been announced by the Shear-Speed Chemical Products Division, Michigan Tool Co., 7125 E. McNichols Road, Detroit 12, Mich. "Shear-Speed Soluble Oil," as this coolant-lubricant is called, does not become rancid or develop an objectionable odor after continued use, is stable, contains an additive to protect the operator's hands against dermatitis, and its pastel blue color eliminates glare.

The emulsion is anti-foaming and non-smoking under normal operating conditions, dissipates heat rapidly, is non-corrosive, and inhibits corrosion on ferrous metals and such non-ferrous metals as aluminum, copper, and brass. The soluble oil concentrate pours at very low temperatures, and will emulsify with hard or soft water in any proportion. Dilutions of 10 to 1 to 40 to 1 are recommended for most machining operations, with heavier operations such as deep cuts and rough-broaching using the lowest ratio.

Thin Masking Tape Provides Positive Holding at High Temperatures

A thin masking tape has been introduced by Mystik Adhesive Products, 2635 N. Kildare Ave., Chicago 39, Ill., known as Mystik Brand Thinflex Masking Tape No. 6207. It is said to be flexible and strong. The backing is made of cellulose fiber saturated with a rubber compound. According to the manufacturer, the tape exhibits a positive holding quality at high temperatures, leaves no residue upon stripping, and performs under adverse weather conditions.

Two Nonflammable Paint Strippers That Do Not Attack Metals

Two paint strippers, Oakite Composition No. 56 and Oakite Composition No. 57, designed for tank immersion stripping and brush-on stripping of a wide variety of alkaline-resistant paints and lacquers, respectively, are announced by Oakite Products, Inc., 126 Rector St., New York 6, N. Y.

The No. 56 composition is a neutral thin-bodied solvent, that is nonflammable, and contains no phenols, cresols, acids, or alkalies. It is used at full strength and is unheated. Then parts to be stripped are immersed for periods of time which will vary depending on the type of paint, number of coats, age, etc. The stripper is said to be safe on steel, brass, copper, zinc, magnesium, and aluminum.

The second of these materials is a viscous solvent intended to replace combinations of non-vis-

cous solvent detergents and thickeners when stripping finishes from vertical and inverted surfaces of equipment. The No. 57 composition is also nonflammable and contains no phenols, cresols, acids, or alkalies. It can be applied safely on all metals at full strength by the brush-on method, and is allowed to soak on surfaces until paint wrinkles or softens. The paint is then hosed or scraped off. When work stripped with either of these compositions is to be repainted, a thorough rinsing is recommended.

Powdered Metal Product that Is Ductile and Strong

An iron powdered metal having the ability to withstand high stresses without cracking has been developed by the Amplex Division, Chrysler Corporation, Detroit 31, Mich. The material is known as Steel Oilite, and exhibits great ductility. Its physical properties are comparable to mild carbon steel, such as S A E 1010, 1020, or 1030. Parts made from this material will withstand compressive stresses up to 70,000 pounds per square inch. The material is not brittle, and may be bent or twisted without breaking.

Steel Oilite can be plated by any of the normal processes, and also hardened by direct quenching, or carburized and hardened. The ductility and strength of the material make possible its use for finished machine parts such as gears, cams, brackets, and lever arms. Although retaining some porosity, it is not intended for self-lubricating applications.

Compressible Shock-Absorbing Glass Material for Machine Mountings

A shock- and vibration-absorbing resilient board material known as "Vibraglass" has been developed by Glass Fibers Inc., 1810 Madison Ave., Toledo, Ohio. Made of compressed and bonded glass fibers, it is actually composed of millions of flexible "glass springs" that support vibrating loads as great as 2000 pounds per square inch at temperatures from minus 100 degrees F. to plus 375 degrees F.

Vibraglass shows no lateral expansion during compression, and recovers immediately after load withdrawal. The inorganic glass fibers are resistant to fire and to attack by such factors as moisture, oil, and fungus. It is insoluble in water and common solvents. Uses to which the material has been put are vibration-absorbing mountings for heavy and light machinery; lightweight shock-absorbing mountings for aircraft and radio computing instruments; and vibration-muffling strips in forced-air furnaces.

Multi-Colored Coating for Protecting Metallic Surfaces of Machines

Coatings in various colors can now be applied to rusted or bare unrusted but treated surfaces, as well as some other painted surfaces. Steelast, as the coating is called, is impervious to moisture, resistant to most chemicals, and is odorless and non-toxic when dry. It will withstand constant wet heat up to 180 degrees F. and constant dry heat up to 300 degrees F. The coating can be sprayed, brushed, or dipped on, and dries for handling in a half to one hour after spraying. The uses to which Steelast has been put are the protection and finishing of metal surfaces on original equipment; and the maintenance of surfaces on machinery, pipes, tanks, duct work, and metal building materials. The compound is available in ten colors from Steelcote Mfg. Co., 3418 Gratiot St., St. Louis, Mo.

Rust-Inhibiting Compound for Cleaning Metals

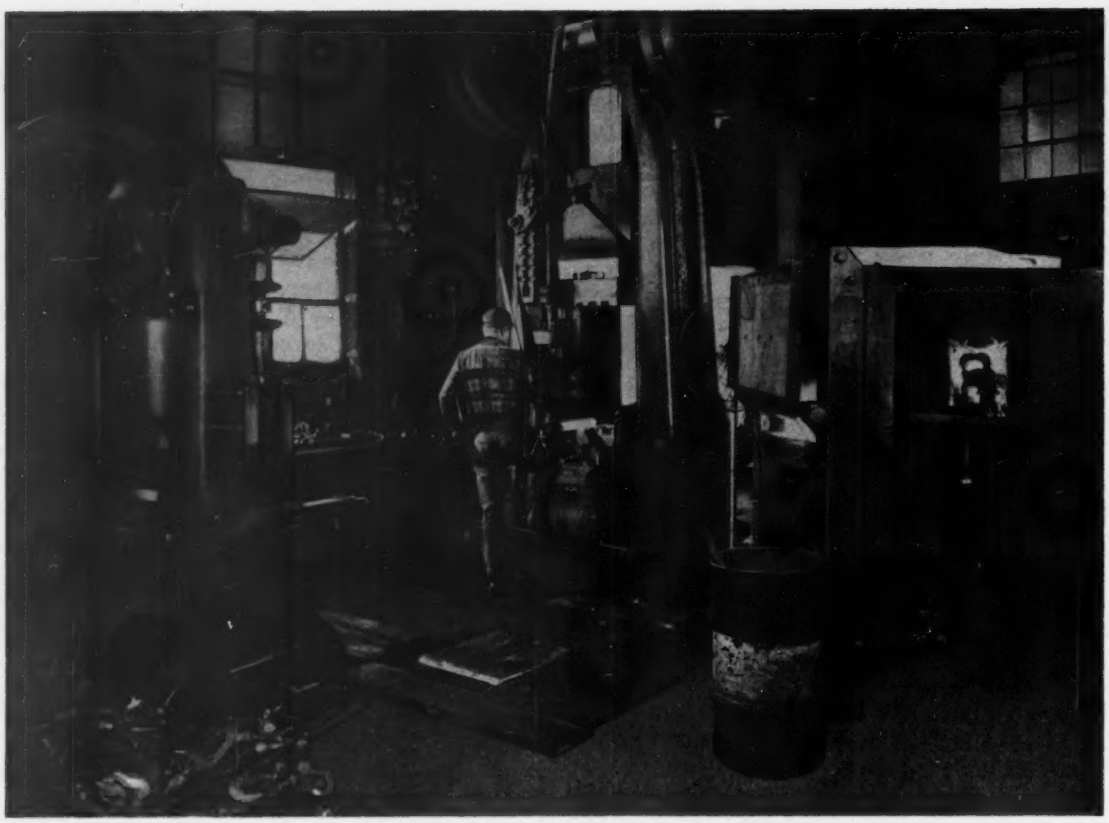
Powrite, a rust-inhibiting metal-cleaning compound, is being manufactured by the Whitfield Chemical Co., Department 15-A, 14225 Schaefer Highway, Detroit 27, Mich. The compound, which is dust-free, granular, water-soluble and low-foaming, may be used in power washers, tanks, or spray booths in concentrations of 1/2 to 4 ounces per gallon of either hot or cold water. Rinsing after cleaning is unnecessary, although advantageous for some applications.

It is used for removing oil, dirt, chips, and abrasives from all types of metal surfaces. Other uses include cleaning before phosphatizing; maintenance cleaning of paint; and conditioning hard water to prevent scale or rust in mechanical washers, steam equipment, and grinders.

Permanent or Strippable Coating Provided by a Hot-Melt Plastic

A strippable hot-melt plastic coating that does not exude oil on standing at room temperature has been made available by Fidelity Products Corporation, 470-474 Frelinghuysen Ave., Newark, N. J. Dip-Pak No. 637, as the coating is called, has a base plastic of cellulose acetate butyrate and is tough, flexible, and strong. It melts at 360 degrees F.

The plastic compound is usually melted in a pot into which the parts to be coated are immersed. The uses to which the compound has been put are for permanent coatings on metal; for insulating and potting objects not subjected to heat; as a plating stop-off; and as a temporary strippable coating for metal objects.



Forging of Titanium Requires Special Techniques

By GORDON S. TRACY
Consolidated Industries, Inc.
West Cheshire, Conn.

TITANIUM, sometimes called the new wonder metal, is rapidly finding new applications in industry. For applications where high strength to weight ratio is required, or where a light metal must withstand extended exposure to heat and the elements, designers and engineers have been engaged in extensive development work with titanium.

A few companies, particularly in the fields of aircraft, ordnance, and naval installations, have used titanium in sheet, strip, or plate form for a limited amount of actual production work. The General Electric Co., however, is bringing other forms of this metal through the experimental stage with the objective of producing parts in quantity for aircraft jet engines.

The speed at which this program is progressing is rather clearly illustrated by the experience of Consolidated Industries, Inc., West Cheshire, Conn., which furnished many of the forgings for G-E's jet development program. Forgings of titanium are now being produced by this company in a number of different sizes and shapes, as shown in Fig. 1, not only for jet-engine parts but also for landing-gear and structural members. The parts involved are classed as small forgings and weigh up to about 10 pounds.

For many years, Consolidated Industries have engaged in forging steel and aluminum, with particular emphasis on aircraft forgings. Upon the advent of titanium, they devoted much time

to this new metal, producing hand forgings for test purposes and experimenting with die designs, heats, and forging techniques. As a result, they were one of the first to actually turn out forgings of titanium on a production basis, working with both commercially pure titanium and with the available forgeable titanium alloys.

Before production forgings could be turned out in quantity, many problems had to be met and solved. In the forging of titanium, it was early discovered that the dies used for stainless-steel parts could not be used successfully on the same parts made from titanium. Titanium has less shrinkage than steel; thus, in the sinking of the dies, this factor must be considered. Furthermore, titanium does not scale the same as steel, and even the slightest tool marks on the die surfaces will be transferred to the forgings. Great care has to be exercised in finishing the die surfaces, with a final buffing operation necessary for satisfactory results.

It was also discovered that in forging titanium the material should not be moved too fast under the hammer blows. The temptation to use over-size hammers was avoided by selecting a hammer of the correct size and moving the metal by repeated blows instead of attempting to flow too much with one blow. Compared to forging of stainless steels, the reduction of titanium during the finishing operations was found to be about 30 per cent less under each stroke of the hammer.

In order to produce acceptable forgings of titanium, the bar stock must have very smooth surfaces, free from surface cracks or even tiny scratches. Seams with depths of less than 0.002 inch have often resulted in scrap forgings. To overcome these difficulties, the bar stock should be centerless ground.

Titanium can be satisfactorily worked only between a narrow range of temperatures, thus extremely rapid handling from the furnace to the hammer is essential. With heavier forgings, or those of complicated designs, frequent reheats often become necessary. Under lower forging temperature, titanium, although plastic, has a tendency to build up in layers rather than to flow evenly, and thus requires constant vigilance in the forging operations. There is a narrow temperature range varying with the size and shape of the part being forged, and fabrication of the part must be done as fast as possible with quickly repeated blows for the best results.

Fortunately, titanium lends itself readily to reheating. In fact, the heating presents no great problem other than attaining the proper temperatures with the least possible oxidization. At the higher temperature ranges, titanium oxi-

Fig. 1. Examples of titanium drop-forgings. Three pieces at bottom are airframe components, and the remainder are jet-engine parts.

Fig. 2. Stresses in titanium forgings are relieved by heat-treatment. Pure titanium is annealed at about 1250 degrees F. and air cooled.

Fig. 3. After being heat-treated, the hardness of the titanium forgings is checked by means of the Rockwell tester here illustrated.

dizes very rapidly. On small parts the optimum working range is usually from 1500 to 1750 degrees F. When the temperature drops below 1350 degrees F., the metal tends to resist the impact of the hammer, thus restricting the amount of smooth, effective flow. Titanium should never be forged at temperatures below 1350 degrees F., as to do so tends to materially increase the hardness of the forgings.

The heating of the metal prior to forging is accomplished in furnaces located right beside the hammer for the fastest possible handling. In producing small parts, quickly repeated blows with immediate trimming have produced forgings of better internal structure. The furnace, drop-hammer, and trimming press are closely spaced in a triangular pattern. This permits less chance of flaws by oxidization.

Prior to shipment, the forgings are given a heat-treatment in furnaces, such as the one shown in Fig. 2, to relieve stresses. With commercially pure titanium, the usual procedure is to anneal at a temperature between 1200 and 1300 degrees F., and then air cool. Care must be taken to have the furnace free from iron scale, or very rapid oxidization will take place. If the parts are heated at 1650 degrees F. for one hour, followed by air cooling, the result is a surface hardness which is sometimes useful on unmachined surfaces that will be subject to friction. The hardness of the forgings is checked on a Rockwell tester, as seen in Fig. 3.

Descaling and cleaning can be accomplished

by the use of various chemical methods or by abrasive blasting. With titanium forgings, ductility is usually very important. Embrittlement is apt to occur unless the heat prior to forging is held to close limits—these limits being determined by the size and shape of the forging, and by the working schedule during which the reductions are being made. An excessive number of heats, combined with improper handling under the hammer, are apt to result in a granular formation which lends itself to fractures.

Internal discontinuities must be avoided. Since titanium is non-magnetic, Magnaflux testing methods cannot be adapted to titanium forgings. Surface inspection by Zyglo or Dy-Chek is a standard practice. For checking internal soundness, X-ray is frequently employed. Also, sonic methods are being developed for this use.

During 1952, the facilities of Consolidated Industries were twice increased—partly due to the demands for forgings of titanium and partly to the greater use of aluminum and steel forgings in modern high-speed, thin-winged aircraft for defense needs. At the present time, a new die shop is being built to handle dies used in forging titanium. In solving the many problems involved in forging titanium, the company has benefited greatly from the experience and technical research made available to them by the Thomson Laboratory of the General Electric Co.

Directory of Tool and Die Manufacturers

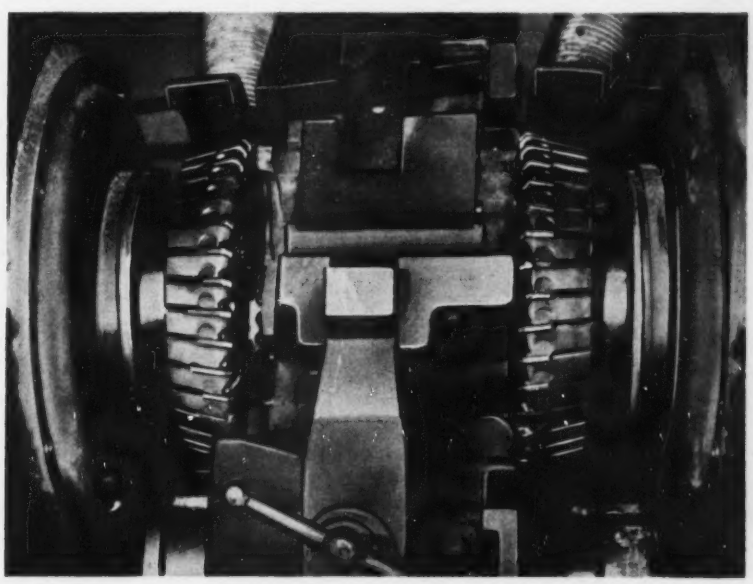
A directory of independent tool and die manufacturers, the first of its kind ever compiled, has been published by the Office of Small Business, National Production Authority. The directory lists approximately 1500 producers of special dies, molds, jigs, fixtures, gages, machines, and related products. It is intended to expedite actual production for defense and defense-supporting requirements. It is arranged to show by symbols the types of special tools and related products each manufacturer is prepared to furnish, the location of his plant, and its size in terms of employes.

Copies of this directory can be purchased for 25 cents each from the United States Department of Commerce, Division of Printing Service, Distribution Section, Washington 25, D.C.

Long Life of Carbide Milling Cutters

From 3000 to 3500 cast-iron gear-cases for automatic transmissions are straddle-milled with the set-up shown in the illustration before the cutters require any regrinding. The operation is performed on a Davis & Thompson drum type milling machine equipped with two cutters for rough-milling and two for finish-milling.

The four axial-face, 12-inch diameter cutters, produced by Kennametal, Inc., Latrobe, Pa., each have thirty-six solid blades of Grade K6 tungsten carbide. A cutting speed of 250 surface feet per minute (80 R.P.M.) is employed, and the castings are fed past the cutters at the rate of 26 inches per minute (0.009 inch per tooth). Average depth of cut for the roughing cutters is 3/16 inch per side, and in finish-milling, about 1/32 inch of stock is removed per cutter.



Cutters employed on drum type milling machine straddle-mill more than 3000 cast-iron gear-cases before they require regrinding

Sorting and Feeding Shells Closed End First

By W. M. HALLIDAY

HOLLOW-DRAWN cylindrical shells often present handling difficulties when they must be fed rapidly and continuously to an automatic machine with the closed end foremost. This is especially true when the shells are fed to a sorting mechanism from a hopper.

The hole in the press-drawn shell *W* extends approximately two-thirds the length of the piece. Rapid delivery of this shell with its closed end foremost was required to insure economical production. The sorting mechanism for this job had to be of simple design, mechanically actuated, and relatively free from clogging tendencies.

The shells fall unassorted into a large hopper from a drawing press. By simply agitating the hopper, the shells pass down the vertical portion of a chute which feeds them into the short horizontal section *A* leading to the sorting and feeding mechanisms. The hopper and the vertical portion of the chute which holds about twelve shells are not illustrated. The sorting or feeding mechanism is interposed in the horizontal portion of the chute.

Chute *A* is a cylindrical steel tube with an inside diameter of sufficient size to permit an easy flow of parts *W* down its vertical portion and through the horizontal section. The end of chute *A* is fitted into a hole drilled through a boss in the left-hand wall of the cast-iron sorting body *B*.

Body *B* has flange extensions *D* with hold-down bolt holes *E* for fastening the sorting mechanism to a bracket extension on the press frame. A deep slot *F* is the sorting chamber of the device into which the shells must pass. The floor of the slot is approximately 1/32 inch below the bottom edge of the bore of chute *A*, as shown in the lower view. Slot *F* is about 0.050 inch wider than the over-all length of the shell *W*.

The walls at each end of slot *F* serve as positive stops to control the sliding movements of the short hardened and ground steel slide *G* which is fitted to move easily in the slot. This slide is considerably shorter than the slot length to allow a movement of about 7/8 inch. The depth of slot *F* and the thickness of slide *G* are equally important, and are made not less than three-quarters of the over-all length of the shell.

The slide thickness should be about 0.005 inch less than the depth of the slot to allow a free working fit. The slide is actuated by a simple rotating barrel cam (not shown), linkage between the cam and slide being provided by the short connecting-rod *J*. The shank of rod *J* is screwed permanently into the end of the slide and passes through clearance hole *K* in body *B*.

Each revolution of the barrel cam causes slide *G* to make forward and return movements of 7/8 inch. The cam is designed to provide a short dwell period for the slide at each point of reversal. These reversal points coincide with the positions in which the shell is loaded into slot *O* and ejected from it. The width of slot *O* is slightly greater than the outside diameter of the shell, and the depth is made not less than seven-tenths of the over-all length of the shell, although the diameter may influence the depth dimension.

When slide *G* is in the retracted position, a shell will pass readily from chute *A* into slot *O* so that one end is in contact with the right-hand side of the slot *F*. As slide *G* moves forward within slot *F*, the shell will be carried along, and the plain end of the slide will automatically blank off the mouth of chute *A* to prevent another shell from passing into slot *F*.

In the floor of slot *F* are two outlet wells *P*. The sides of these wells are inclined, as shown in heavy broken lines below bridge *Q* in section *X-X*. The minimum width dimensions of each well should be made appreciably greater than the outside diameter of the shell. An allowance of 1/8 inch was found satisfactory. Bridge *Q* between the wells and central with the width of the slot *F* has the top surface machined below the normal floor surface of the slot 1/64 to 1/32 inch.

The crest of the bridge is slightly domed, as shown by the heavy dotted lines in section *X-X*. The width of the bridge at its topmost point is relatively narrow, being about one-third the outside diameter of the shell *W*. The base of each well is drilled to receive the outlet tubes *R*, which enter from the under side of the body and are tightly secured in place.

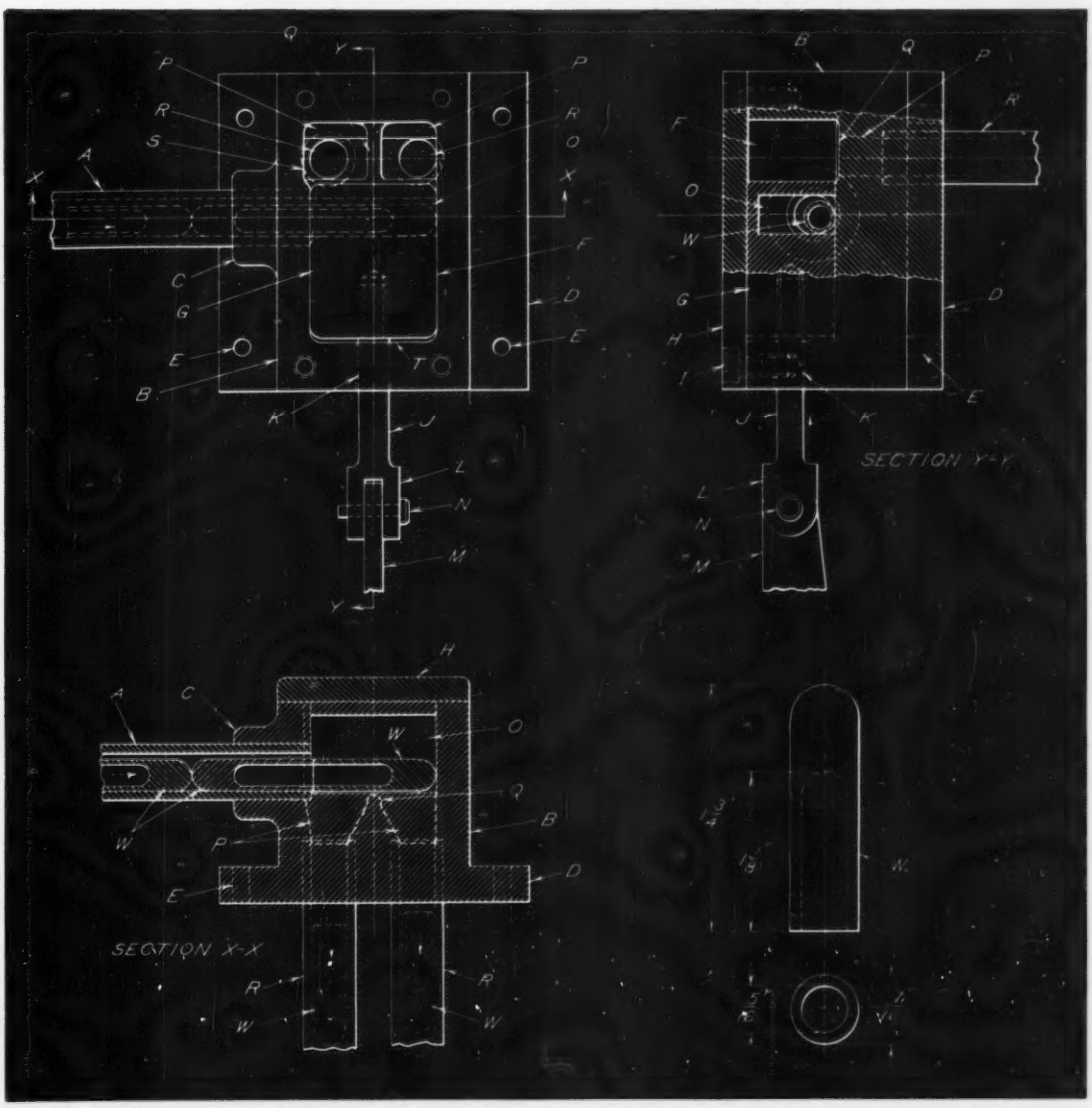
The two tubes *R* converge, forming a single tube of slightly larger diameter which feeds the shells directly to the dial mechanism of the press. The junction point of tubes *R* is omitted from the illustrations. The left-hand wall of the slot *F* adjacent to well *P* is stepped back, as shown at *S*,

to give additional clearance for the shell when it is being changed from the horizontal to the vertical position by tilting or pivoting over bridge *Q*. This step is not carried to the mouth of the chute tube *A*, and need be only about 3/32-inch deep for a shell of the dimensions given.

Slide *G* is shown in the loading position and near the extreme end of its stroke. In this position, slot *O* will be in alignment with the outlet of chute *A*, and since a considerable number of shell components will be carried in the chute, the weight of those in the vertical portion will exert enough pressure to push the first shell into slot *O*.

The illustration shows the work or shell located with its domed end foremost and lightly pressed against the right-hand wall of slot *F*. As soon as the shell is positioned in slot *O*, slide *G* is moved forward by the link-cam drive, for a distance of approximately 7/8 inch. This movement will also be imparted to the shell contained in the slide. The same movement of slide *G* serves to close up the end of the chute *A*, thus preventing the next shell in the bore of the chute from entering slot *F*. The blank side of slide *G* passing across the mouth of the chute *A* will hold the line of shells in position throughout the remainder of the slide movements.

The slight radius formed on the left-hand vertical edges of slot *O* will facilitate the passage of the slide past the second shell, and, in fact, will gently force that component back into the chute for a distance of about 1/32 inch. When the slide



Mechanism by means of which shells that are fed either open end or closed end first into a feed chute are all sorted and fed closed end first into chute leading to press for succeeding operation

has moved to its extended position at the far end of slot *F*, the shell in slot *O* will be in correct lateral alignment, at right angles to bridge *Q* for the sorting operation.

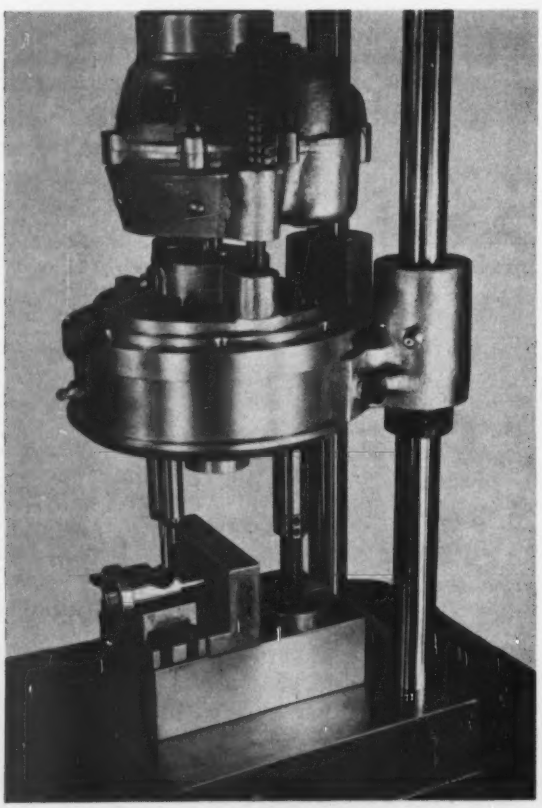
In this position it will be supported only at its mid-point by the very narrow bridge *Q*, and since the domed end is much heavier, it cannot remain balanced on the bridge *Q*, but will immediately tilt over in a clockwise direction and pass into the right-hand well *P*. It then passes down the vertical outlet tube *R* with its domed end foremost as shown by the broken lines in the section *X-X*.

A shell advancing to slot *F* with its open end foremost will enter slot *O* and be traversed to the opposite end of the sorting chamber in exactly the same manner as a shell entering dome end first. But this time the heavy end of the shell will lie to the left of bridge *Q*, and therefore the shell will immediately tilt over in a counter-clockwise direction, pivoting on the bridge *Q*. Thus the shell passes into the left-hand well *P* and down outlet tube *R*, with its solid end foremost. Regardless of which end of a shell enters the slot *F* from chute *A*, it will always be deposited in one of the outlet tubes *R* in the correct position, with the dome end downward.

A certain dwell period is provided at each end of the slide stroke to allow sufficient time for loading and turning the shell. Despite this requirement, it was found that a very short cycle could be used successfully. Actually the cycle required only eight seconds, including two periods of three and one-half seconds each for loading and turning of the shell into the outlet tube. This operating speed permits about 400 shells to be sorted correctly per hour.

Lead-Screw Multiple-Head Tapping

The multiple tapping of two or more small holes can be done economically with lead-screw protection on any drill press according to the Ettco Tool Co., Inc., Brooklyn 37, N. Y., with Ettco-Emrick self-contained lead-screw multiple tapping units. This is possible even though the tap sizes, pitches, or both, are not the same.



Multiple tapping unit set-up for tapping holes in aluminum parts

The unit shown in the illustration—consisting of a reversing head, a three-spindle head, and a fixture—taps two 0-80 holes in aluminum. The lead-screw, having a fast pitch, runs slower than the taps and is completely enclosed during operation, thus assuring precision tapping with long life.

* * *

Large-Scale Fabrication of Zirconium

A key metal being used in construction of the first atomic submarine engine, zirconium will be fabricated in quantity during 1953, according to a forecast made by two Westinghouse scientists who helped develop new fabricating methods. Starting with laboratory work on 2-pound pieces of zirconium in 1949, parts are now being formed, rolled, and machined from ingots 1 foot in diameter and weighing up to 500 pounds. Since that date, Westinghouse has been at work on the nuclear reactor and associated propulsion equipment for the first atomic submarine—the *U.S.S. Nautilus*.

For the water-cooled nuclear reactor, zirconium has been ranked only second in importance to uranium as a vital material. It is lighter than steel, has remarkable corrosion resistance and an extremely high melting-point, and is strong and workable. Most important for its use in a nuclear reactor is the fact that it does not absorb, and thus "waste," neutrons—the atomic particles used to bombard uranium atoms, thereby producing the necessary nuclear reactions.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Economically Designed Die for High Production of Small Clips

By ROGER ISETTS, Kenosha, Wis.

Illustrated in Fig. 1 is a small clip used extensively in the electrical equipment field. Since production of this item is extremely high, the die for it must be able to withstand the rigors of constant use and not be in the toolroom continually for repairs. Besides being accurate and rigid, the die must be simply constructed, so repairs can be speedily made when required.

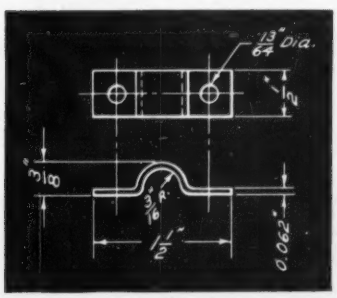


Fig. 1. This clip is pierced, formed, and cut off in a single operation.

A cross-sectional view of the die designed to produce the clip is shown in Fig. 2. Punch-holder pad *A*, made of cold-rolled steel, is screwed and doweled directly to the top shoe of the press, and carries the two hole-piercing punches *B* and the cut-off and form punch *C*. Block *D*, made of hardened tool steel, is mounted on the die-shoe and serves the dual purpose of being a stock stop and a back-up for punch *C*.

Form-block *E* is sunk in the die-shoe and held down with two cap-screws. Around this block is a stripper *F* which travels up and down over two springs *G*. Keepers *H*, which are screwed and doweled to the die-shoe, serve to restrict the travel of the stripper during the up stroke of the press ram.

In the top shoe is a hardened knock-out pin *J* that works against a spring *K* to eject the completed clip should it stick in punch *C*. All parts of the die are easily accessible.

A jet of compressed air synchronized with the up stroke of the press ram blows the clip into a bin at the rear of the machine, so that the operator's hands at all times can be a safe distance from the die.

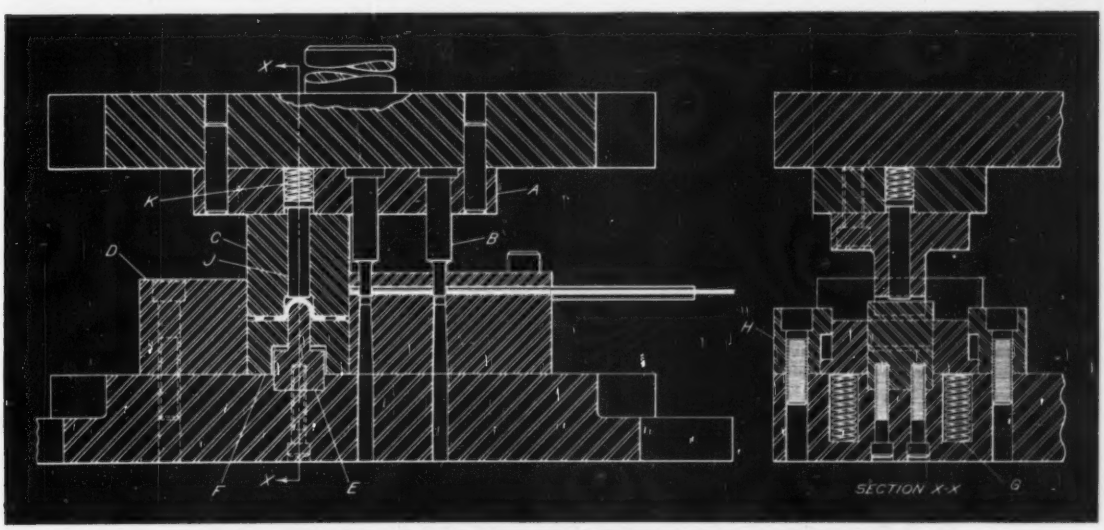


Fig. 2. As can be seen in this cross-sectional view, all parts of the die are easily accessible when it becomes necessary to make repairs.

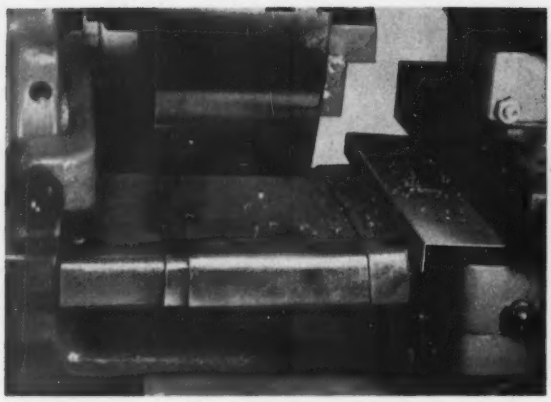


Fig. 1. As the carriage moves to the left, the guard collapses when the corner piece abuts against the headstock.

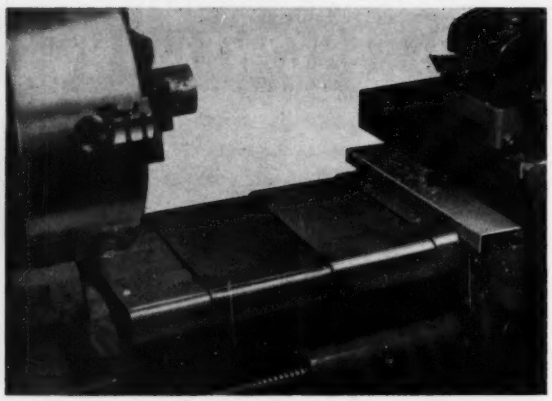


Fig. 2. When carriage moves to right, guard extends as corner piece catches against the ends of the ways.

Telescoping Guard Protects Lathe Bedways

By CLIFFORD T. BOWER, London, England

To maintain the accuracy of lathe bedways, they must be protected from scoring by chips and from damage by dropped tools or heavy objects, and be kept covered with a lubricating film. Lathes with flat bedways require particular attention. Chips and dirt quickly accumulate on the flat surfaces, and the operator frequently has to wipe them before moving the carriage. The wiping removes the lubricating film, however, so that even if the ways are clean, wear will result from the lack of oil.

The problem is nicely solved where a gap exists between the headstock and the bedways by means of a simple telescopic guard, as can be seen in Figs. 1 and 2. In Fig. 1, the three-section guard is collapsed, with the carriage close to the chuck and the first section of the guard abutting against the headstock. In Fig. 2, the guard is

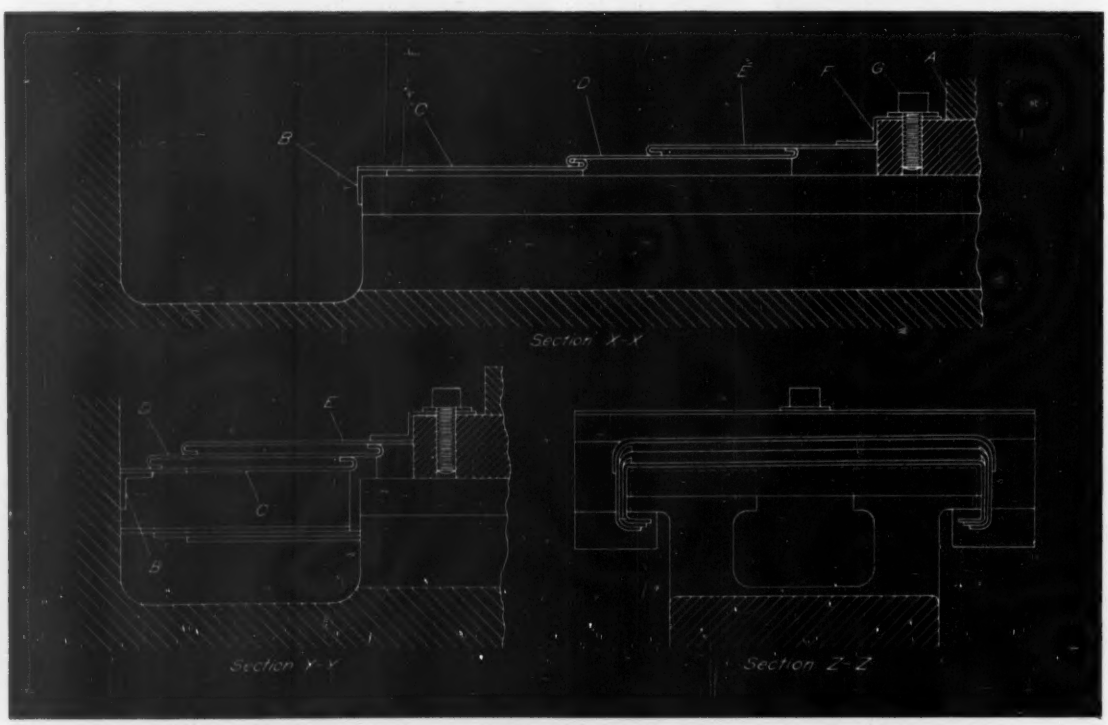


Fig. 3. Cross-sections showing operation of the guard—X-X along the bed, with the guard partly extended; Y-Y along the bed, with the guard collapsed; Z-Z across the bed, illustrating channel design of guard.

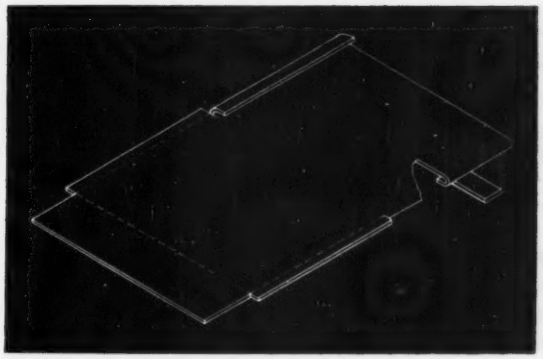


Fig. 4. Typical guard section, showing shape and bending of cut-out blank

partly extended, with the carriage farther from the chuck and the first section caught against the ends of the ways.

The greater amount of lathe work can ordinarily be performed within the maximum extension of the guard. (In the illustrated application, at the maximum extension of the guard there is a distance of 12 inches between the tool tip and the chuck.) If the carriage must traverse the gap for a between-centers operation, or if the full swing over the ways must be utilized, the guard can be easily detached by means of a single cap-screw.

The construction of the guard is shown in Fig. 3. Section *X-X* is taken along the lathe bed, with the guard partly extended. As the carriage *A* moves to the right, a corner piece *B*, which is riveted to the first section *C* of the guard, catches onto the end of the bedways. Additional carriage movement to the right (to the point illustrated) causes the second section *D* to hook itself onto the bent-over lug of the first section. The third section *E* will hook itself onto the second section if the carriage moves farther to the right. A Z-shaped piece *F*, riveted to the third section, accommodates a cap-screw *G* by which the guard is held to the carriage.

The positions of the sections when the guard is collapsed are shown in section *Y-Y*. As the carriage moves to the left, the corner piece *B* abuts against the headstock, and the sections then telescope. Section *Z-Z* gives an end view of the guard, showing how the sides are bent over horizontally at their lower ends. This feature makes the guard self-supporting and produces the telescopic effect.

In Fig. 4 is a sketch of a typical section, one-half indicating the shape of the cut-out blank, and the other half, the finished piece bent to shape. Three blanks are cut from thin sheet steel to the shape indicated. The lugs at both ends of the section are bent first; then all three sections are superimposed and bent to the channel section required, by hammering their sides around a wooden-block former. The external dimensions of the former correspond to the internal dimensions of the finished guard. Removing this former then leaves all three sections fully assembled and capable of sliding on one another.

Vee Type Back-Up Block Utilizes Scrap Bar Stock

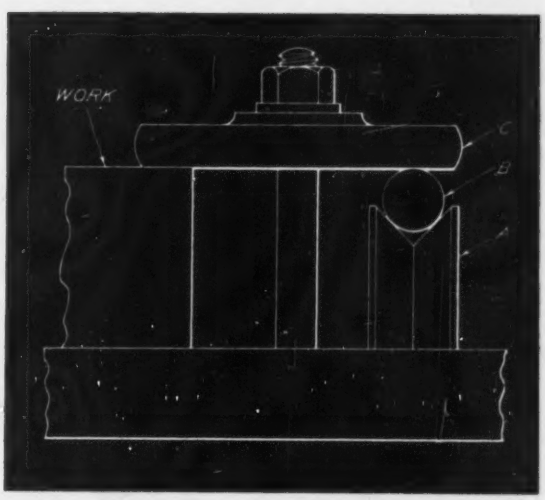
By JOSE SOBKOWIAK

Illustrated here is a clamping arrangement in a set-up on the table of a machine tool in which a special back-up block *A* is used in combination with a piece of scrap round stock *B* beneath the heel of the strap *C*. The back-up block is rectangular, and has a 90-degree vee in one end and in one side. Pieces of scrap of various diameter can often be found near the cut-off saw in the shop. It is usually possible to select a piece which, when set over one of the vees, will support the strap in a horizontal position.

The round stock cannot slip out of the vee, and directs the clamping pressure squarely on the machine table. A set of four of these blocks comes in handy around a drill press, milling machine, planer, or shaper.

• • •

Drought held the spotlight in aluminum production during the last quarter of 1952. It is estimated that power shortages due to scanty rainfall cost the industry upward of 100,000,000 pounds of metal. However, facilities installed in 1952 increased production about 20,000,000 pounds over the record set in 1943.—*The Aluminum Bulletin*



The back-up block *A* and the scrap stock *B* support the strap *C* in a horizontal position

Gaging Broaches by Optical Projection

OPTICAL gaging has now been adapted to checking the teeth of broaches for form, spacing, and wear for the entire length of a broach. A specially designed broach-locating fixture, developed by Optical Gaging Products, Inc., Rochester, N. Y., is locked on the work stage of a Kodak contour projector, as shown in Fig. 1. On the base of this fixture is mounted a broach slide and indexing head. The slide is moved on ways by turning either of two pinions meshing with the rack attached to the rear of the slide.

The broach rests against mounting blocks of the indexing slide member and against a magnetic stop at the end of the slide. The magnetic end stop is adjustable to allow for lateral movement of the broach, if necessary, without moving the entire fixture or work stage. When checking various teeth, the broach is indexed across the path of the optical system in accordance with accurately positioned indexing notches.

The indexing head is fixed to the base member of the fixture, and carries two special metal mirrors, which can be moved as a unit in and out between the teeth of the broach, to positive stops at each end of its travel. Positioning of this mirror assembly against the forward stop places the mirrors on either side of a row of teeth for tooth-to-tooth inspection. Inadvertent forward thrust of the mirrors against the broach is prevented by a stop-pin which must be raised in order to allow forward movement of the assembly toward the broach. Pulling of the index handle first removes the mirror assembly from the broach, and next pulls the stop from the index bar, in a double action.

An adapter is supplied with this fixture, which is inserted behind the standard 45-degree mirror attachment of the contour projector. This is used in order to extend the focal position for the broach. Light coming from the 1000-watt surface illuminator is directed, by means of the 45-degree mirror attachment, down toward the two special metal mirrors. The light striking these mirrors is reflected toward the opposite metal mirror and then returned upward through the same optical system from which it came. This results in a silhouette shadow of the tooth form being projected at the desired magnification onto the viewing screen, as shown in Fig. 2.

The contour of the teeth is checked against precision-made lines on a chart-gage viewing screen, and any deviation of tooth profile to the master lines is readily noted and can be measured. Magnification used for the illustration was 20 times, although provisions were made for checking at

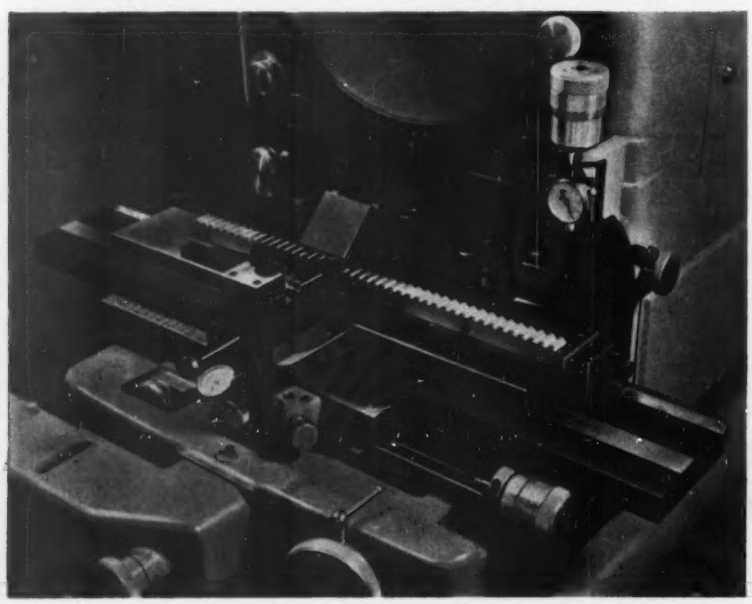
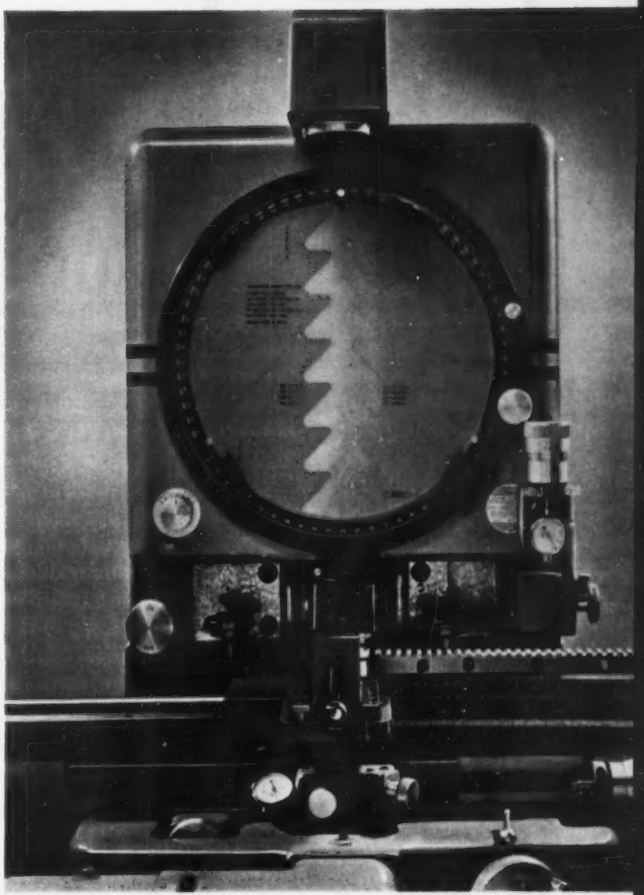


Fig. 1. Specially designed broach-locating fixture locked on the work stage of a Kodak contour projector for checking tooth form, spacing, and wear.

Fig. 2. Magnified silhouette shadow of broach-tooth form is checked against precision-made lines on a chart-gage viewing screen.



50 times the tooth form on the same chart. A screen image can be obtained of the front cutting view, top view, and rear edge view when desired by this method. The two special metal mirrors are separately adjustable right and left to allow for various thicknesses of broach teeth and adjustable in the vertical direction to allow for various form depths. These adjustments are made only when changing from one type of broach to another, and are then locked into position by means of set-screws.

* * *

Aluminum Ingots Heated Rapidly with 60-Cycle Current

Using ordinary household electric power, the Aluminum Company of America has succeeded in heating a 7700-pound aluminum ingot to working temperatures nearly fifteen times faster than could be done in a conventional furnace. This technique of 60-cycle induction heating will be invaluable in heavy-press production of big aircraft aluminum forgings and extrusions.

Until this low-cycle technique was developed, Alcoa used conventional methods, such as soaking pits or other furnaces, in all its operations to bring ingots to proper forging or extrusion temperatures. Heating a 7700-pound aluminum ingot to 750 degrees F. used to require about twelve hours, as compared with the fifty minutes for the low-frequency induction method.

In essence, the new method consists of placing an unheated ingot into a specially designed electrical coil. Electric energy of commercial frequency is then applied to the coil. The electric current flowing through the coil induces a heavy current in the ingot itself, and this produces the temperature rise in the metal.

When the company first started work on low-cycle induction heating, low-frequency coils were considered impractical and inefficient. Induction heating then used only current of higher than commercial frequencies, requiring expensive conversion equipment. At first, work was done with 9600-cycle coils. As experiments continued, 1000-cycle coils were used, then 360, 180, and finally, 60 cycles, the same frequency as household current. With each successive drop in frequency, efficiency was improved.

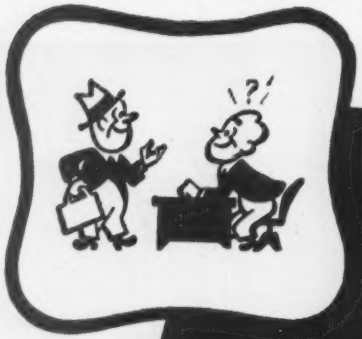
This induction heating method compares favorably with previous installation and operating costs, and permits the use of smaller equipment. Increased flexibility is provided in the operation of big forging or extrusion equipment. The coil also can be used for annealing and heat-treating fabricated products.

* * *

Suction Cups for Safe Handling of Sheet-Metal Parts

Common rubber suction cups are being used at Temco Aircraft Corporation, Dallas, Tex., to eliminate much of the difficulty normally experienced by punch press operators in the handling of routed parts which have not been cleaned and deburred. To eliminate the need of an extra burring operation, punch press operations are performed on routed parts prior to burring. Operators, however, had experienced considerable difficulty in handling such parts, due to sharp burrs and router coolant oil residue. Minor cuts and broken fingernails were among the hazards.

One punch press operator found a simple solution to the problem by attaching a small suction cup to a ring worn on one of his fingers. The cups facilitate picking up and handling of relatively large parts and have practically eliminated all the difficulties formerly encountered.



The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

Images in the Prospect's Mind

WHAT sort of mental image forms in the prospect's mind as he meets us, watches our actions, and listens to our sales story?

The image each one of us creates is determined by our physical appearance, our manner of delivery, our exhibition of knowledge, and our ability to reason logically. In considering the relationship between ourselves and the prospect, let's center our attention on these four points which can help us in selling.

Physical Appearance—I used to travel with a philosophical sales engineer—mature, experienced, and successful—covering a less populated area in New York State. As we were driving along the highway, he would often reach into the pocket of the panel of his car and pull out an electric razor. After the plug was inserted into an improvised socket on the dashboard, he would slowly stroke his face as he drove. "Got to spruce up a bit," he would say, and while doing so, we would discuss the prospect headed for and the problems involved. Though well on in life, this sales engineer still appreciated the value of a favorable physical appearance.

By and large, the young salesman, although lacking in knowledge and wisdom gained from experience, watches his physical appearance more closely than the older one. It's the custom of the day. How many times, sitting in the prospect's reception room with other salesmen, have we watched a man straighten his necktie, stroke his hair, or brush off some clinging thread from his clothes! Yet again, how often have we seen men who needed a haircut or a shoe shine!

Robert Burns's couplet

"Oh wad some power the giftie gie us
To see oursel's as others see us!"

could have been written with sales engineers as his inspiration!

Manner of Delivery—Human contact by voice, expression, and gesture is consistently important. One salesman of my acquaintance repeatedly interrupts his prospects with the remark "Know what I think?" Following a pause for the purpose of suspense, he then rushes on with a pressure-exerting statement calculated to demonstrate his experience and knowledge.

Another salesman works himself closer to the prospect as he talks, and fairly makes him lean backward in tiresome dismay. Still another assumes a gruff, terse, hard-boiled attitude, imitating that of an older salesman. Others keep fidgeting, backing and filling, agreeing, or just making general statements without conviction or punch.

Let us not learn our sales story verbatim, so that we act like trained seals, but through self-criticism and practice let us develop a pleasing manner that becomes a subconscious part of ourselves.

Knowledge—Most of us form opinions too quickly. An event may happen two or three times and we readily relate that this "always happens." Just a few questions from the prospect as to equipment, application, or service that remain unanswered may classify us in the prospect's mind as one who just doesn't know his business. Even worse than this is an incorrect reply—one that soon undermines our reputation.

We must have a head full of knowledge, but none of us knows everything. A crisp acknowledgment of "I don't know, but I'll find out and advise you promptly" may go far toward establishing an enviable reputation, provided we follow through.

Reasoning Logically—Reasoning and knowledge are closely related—reason uses knowledge to reach definite conclusions. Several incidents come to mind, such as the sales engineer who

pursues a lengthy harangue upon what his machine will do for the prospect. He is finally interrupted by a statement, "But your reasoning is not correct. We can't get those results—you don't understand our conditions."

The two most common shortcomings in the area of reasoning are slipshod procedure and the exaggeration of results to be obtained. Both are disastrous due to their backfire.

If we are to improve the image created in the prospect's mind, we must be fired with a desire to improve it—a desire combined with an enthusiasm that parallels our earnestness in trying to make a sale.

Broaching Arms on Aircraft Engine Spiders

A COMBINATION manual and automatic control set-up developed by Colonial Broach Co., Detroit, Mich., permits broaching of aircraft engine spiders, Fig. 1, with complete support for the part being broached on standard single-ram broaching machines. The identical contours on the six arms of a spider are being broached on the Colonial 6-ton, single-ram broaching machine shown in Fig. 2.

In operation, the spider is placed in the fixture and clamped in place manually, locating from the splined hole. Each cutting stroke of the broach forms the contours between one set of arms on the spider. When the circuit is actuated to start the broaching cycle, supporting jacks in the fixture automatically close in and support the two arms of the spider opposite the surfaces being broached. When the broach has completed the cut, the fixture automatically shuttles clear of the broach and the automatic jacks are released.

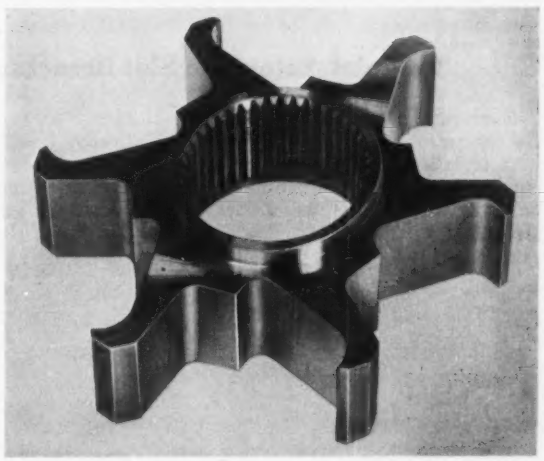
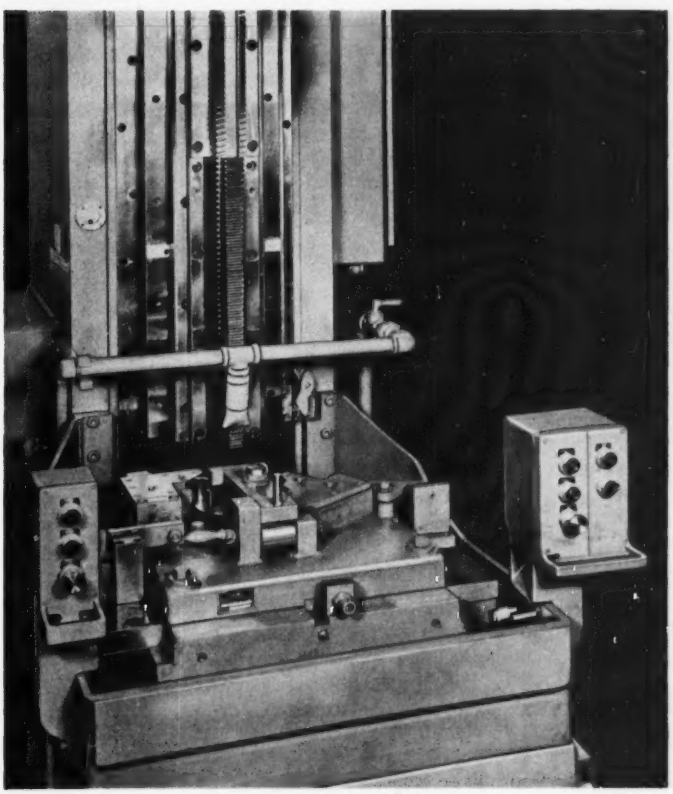


Fig. 1. Identical contours on the six arms of this aircraft engine spider are broached in six passes on the single-ram machine illustrated in Fig. 2.



While the broach is returning, the operator manually unclamps the part and indexes it in the fixture to the next position for broaching the adjoining set of contours. Then the cycle is repeated until all six contours of the spider have been broached. The operator then removes the aircraft engine spider from the fixture and replaces it with another spider to be broached.

Fig. 2. Single-ram broaching machine provided with special combination manual and automatic fixture for broaching arms on aircraft engine spider.

LATEST DEVELOPMENTS IN *Shop*

Colonial Automatic Slot-Broaching Machines for Jet-Engine Rings

Horizontal broaching machines for the automatic broaching of external scallops and slots on different types of jet-engine rings have been developed by the Colonial Broach Co., Dept. M, Box 37, Harper Station, Detroit 13, Mich. Basically, these are standard 10-ton Colonial horizontal broaching machines having working strokes of 60 and 90 inches. They are designed for fully automatic control of the indexing, shuttling, and broaching operation.

The 60-inch stroke machine, shown in Fig. 1, broaches three scallops at each pass of the ram; the 90-inch stroke machine, illus-

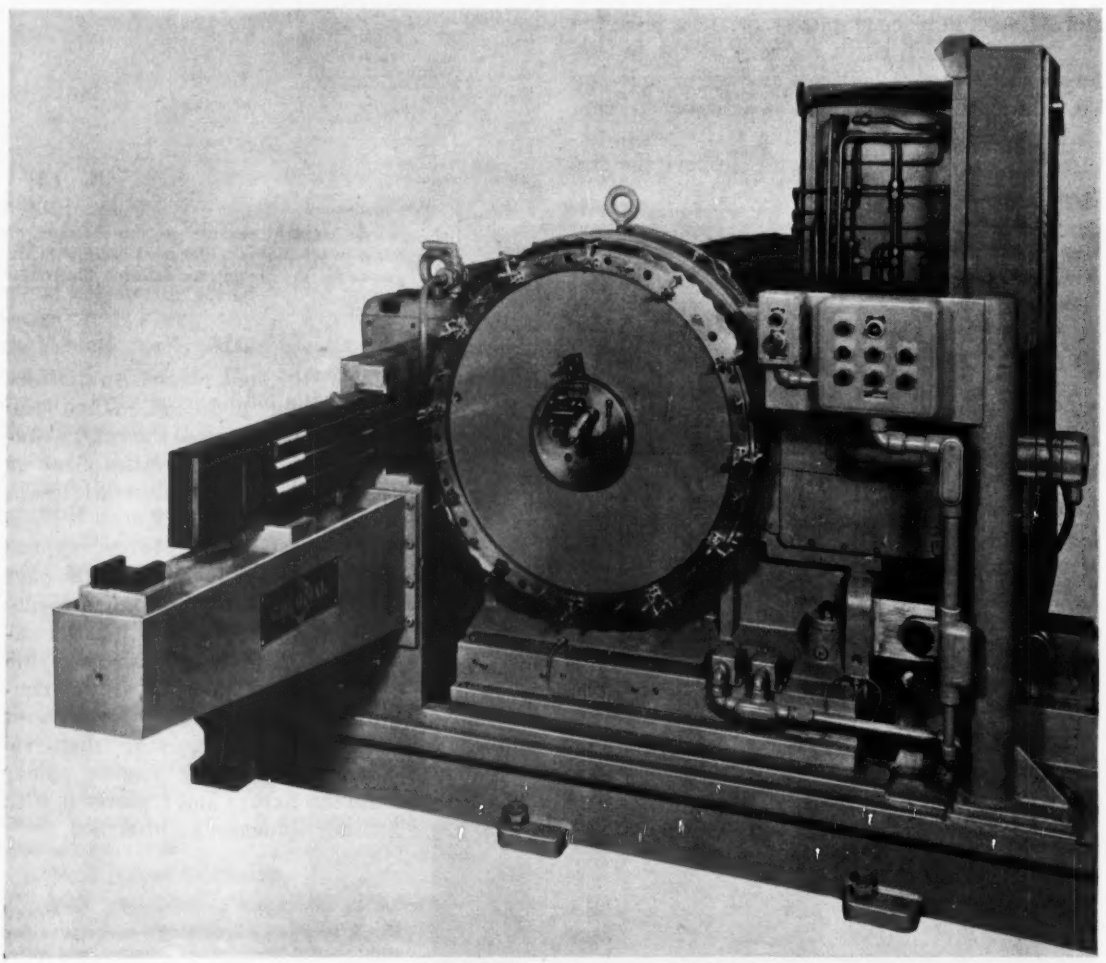


Fig. 1. Broaching machine designed to automatically broach three scallops in jet-engine rings at each pass

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

trated in Fig. 2, broaches a single dovetail slot at each stroke. The ram starts the broaching cut as soon as the work is shuttled into position. At the completion of the stroke, the fixture recedes from the broach and the ram returns to its starting position. An automatic indexing movement brings the succeeding increment of the work into the broaching position. This process is repeated until all slots or scallops are completed. Then the fixture returns to the loading position. Equipment for pneumatic or mechanical ejection of the finished part is optional. Provision is made for power-feed lubrication of the machines at each pass of the ram.

The hydraulically actuated shuttle slides on box type square gibs on the base, and is mounted low to permit handling large-diameter work. Positive mechanical locking is provided to secure the work in the broaching position. Indexing is accomplished hydraulically by means of a change-gear drive and a Geneva movement, controlled by limit switches. Positive plunger locking is provided for the indexing mechanism. Selective electrical circuits are equipped for fully automatic operation, single indexing, or independent inching motions, including both forward and reverse movements.

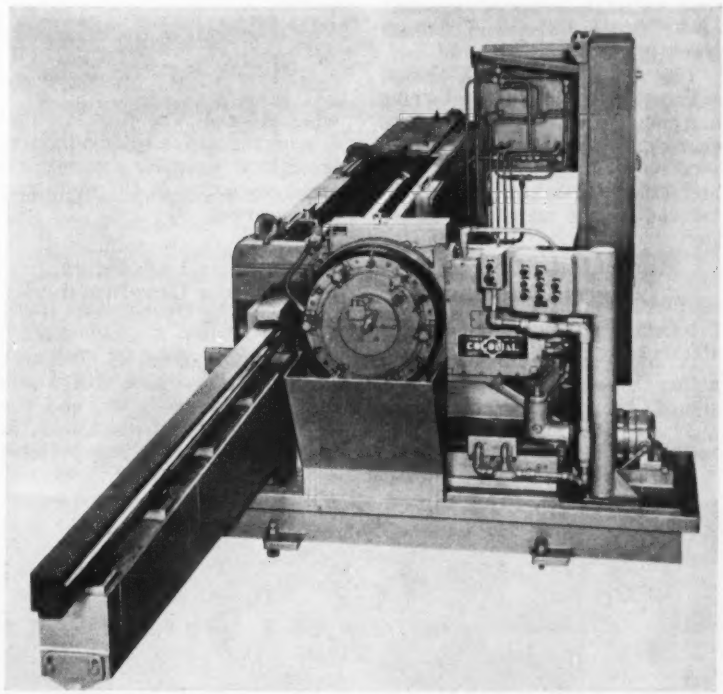


Fig. 2. Colonial broaching machine equipped for automatic broaching of external slots in jet-engine rings

Construction of the machines was planned to permit them to be shipped to the customer's shop in three separate subassemblies.

Cemented-Carbide Inserts for Mechanical Tool-Holders

An expanded line of solid cemented-carbide inserts for mechanical tool-holders is announced by the Carboloy Department of the General Electric Co., 11147 E. 8 Mile Ave., Detroit 32, Mich. This line includes four new blank sizes in two new shapes in the standard unground and ground lines. These carbide inserts have been brought out to provide toolmakers and other users with a wider range of carbide inserts from which to make selections to suit their individual needs.

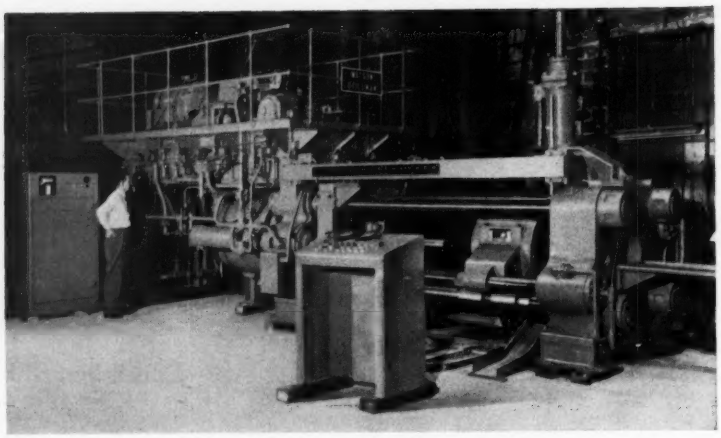
New sizes and shapes added to the line of unground insert blanks include a 5/8-inch diameter inscribed-circle triangular insert; a 55- and 80-degree, diamond-shaped insert; and a 3/4-inch square insert. The square insert is manufactured with sharp corners and standard chamfers, while the other inserts are made with both standard radii and sharp corners.

Inserts added to the stocked standard ground line are a 5/8-inch diameter, inscribed-circle triangular insert, a 55- and 80-degree, diamond-shaped insert, and a 3/4-inch square insert. In addition, all triangular and diamond-shaped inserts are available with special corner radii.

Watson-Stillman Aluminum Extrusion Press

A long-stroke 1250-ton aluminum extrusion press capable of handling billets up to 24 inches in length is being manufactured by the Watson-Stillman Co., Division of H. K. Porter Co., Inc., Dept. M, Roselle, N.J. This is a hydraulically operated, four-column type press equipped with Oilgear radial piston pumps. The long-stroke cylinder permits the billet and dummy block to be loaded into the container on a single forward movement of the main ram. The ram travels at a rate of speed that makes possible the loading of a 24-inch billet and dummy block in only four seconds.

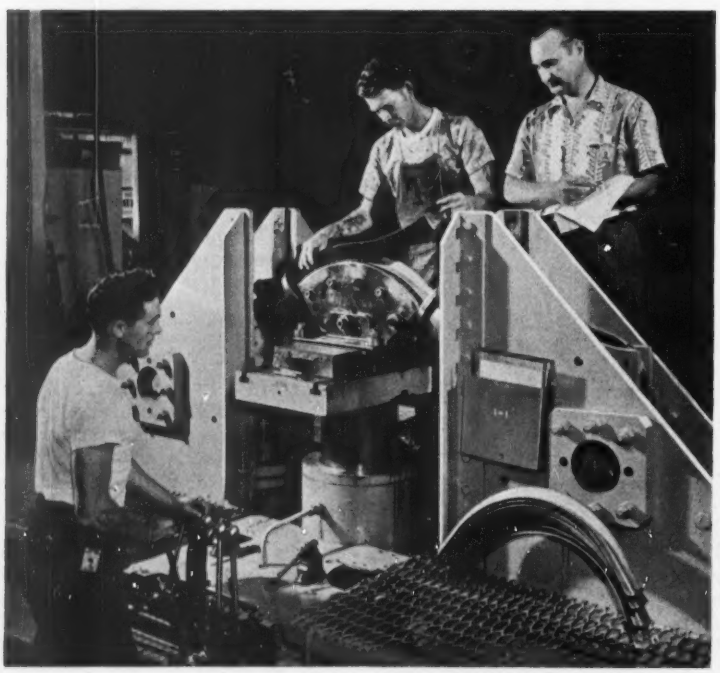
The die slide has a U-shaped opening for mounting the die ring and bolster, which permits rapid changing of dies. Operation is semi-automatic, with interlocks protecting all mechanisms. Control buttons permit manual operation when desired. The control pulpit is equipped with a speed-adjusting lever that provides for stepless speed variation of the main ram of the press.



Long-stroke aluminum extrusion press built by Watson-Stillman Co., Division of H. K. Porter Co., Inc.

Longren-Peterson Stretch-Form Press Developed for Use in Aircraft Plants

A high-production multiple-action stretch-form press, designed for forming aluminum-alloy extrusions and sheets, has been announced by the Longren Aircraft Co., Dept. M, Torrance, Calif. This machine will handle double curvature work, and perform a variety of operations, including stretch-leveling, preforming, wrapping, skin pressing, bending, forming, and stretch-pressing.



Stretch-form press for forming aircraft members from aluminum-alloy extrusions and sheets announced by the Longren Aircraft Co.

As little as two minutes is required to load, form, and unload the work after the set-up is made. Operation is at a pressure of 2000 to 3000 pounds per square inch. The single-action hydraulic system of the press consists primarily of five double-action cylinders, a high-volume pump, and the pump unit. Two vertical and two horizontal cylinders and a center main-ram cylinder can be used in combination or separately to give the machine flexibility. The two horizontal cylinders with 30-inch strokes move the chuck supporting plates horizontally to accommodate parts from 6 inches to 30 feet in length. The two vertical cylinders with 24-inch strokes move the gripper jaws either vertically or horizontally. The center main-ram cylinder with an 18-inch stroke moves the die vertically.

This Peterson press has a rated capacity of 100 tons, and will stretch-form aluminum alloy in the SW condition up to 3 square inches in cross-sectional area and 72 inches in width. Extrusions or sheets up to 16 feet in length and extrusions up to 6 inches in width, can be contour-formed. Material to be formed is laid over the forming die and gripped by chucks. By selecting various combinations of cylinder movements, the die can be made to ascend or descend vertically and the chucks can move horizontally, either closer together or farther apart, so that the material is stretched over the die beyond its elastic limit until it assumes the shape of the die. Parts are formed without spring-back,

and no hand finishing is required after the work has been removed from the stretch-form press.

Forming dies are made of steel, high density woods, plastics, plaster, and Meehanite. A drawing compound of vegetable and mineral oil serves as a lubricant for pressures up to 5000 pounds per square inch.

Forney Profile Milling and Boring Machine

A machine designed to perform irregular profile milling and boring operations on aluminum and magnesium castings and forgings, as well as on cast and rolled armor plate, has been developed by Forney's Inc., New Castle, Pa. This machine is specially equipped with a duplicator and templates. It can be used to advantage for difficult profile machining work required in the manufacture of aircraft and armored vehicle parts.

The machine can be furnished with work-holding fixtures, tooling, templates, and floor-plates as required by the user. The spindle housing serves as a motor-powered unit which is moved to feed the tool directly into the work face. This feature is said to insure more accurate work and give more power and greater rigidity to the cutting tool.

Abbott Improved Barrel Finishing Unit

An improved barrel finishing unit designed to efficiently handle burnishing, deburring, and cutting-down operations has been brought out by the Abbott Ball Co., Railroad Place, Hartford, Conn. Outstanding features include precision speed controls, interchangeable parts, and low operating costs. This compact equipment is built around the high, vertical barrel which was first developed and marketed by the manufacturer. Power is supplied by an electric motor mounted on the barrel pedestal. A standard motor base is provided to accommodate several sizes and makes of motor.

Precision speed control is maintained by a reduction drive attached directly to the barrel shaft. Speed of the barrel is adjusted through a combination of sheaves.

Abbott barrel finishing unit

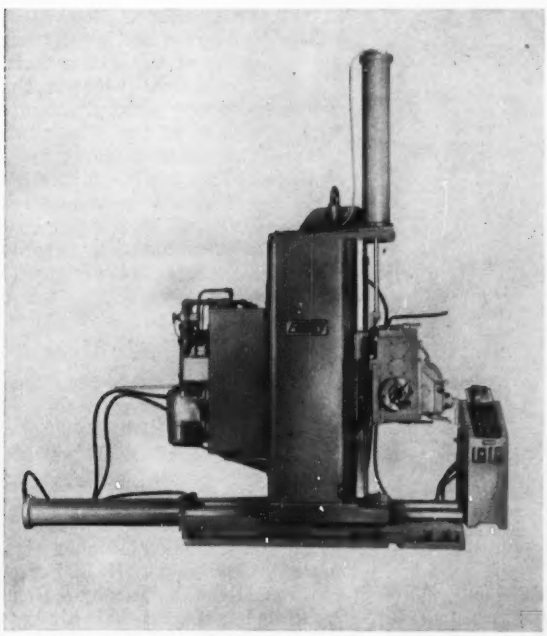
The unit is controlled with a push-button safety switch which can also be used to "jog" the barrel to any desired position.

The units are made in four standard sizes and are available in ten basic combinations with single, double, and triple compartments to fit the user's requirements.

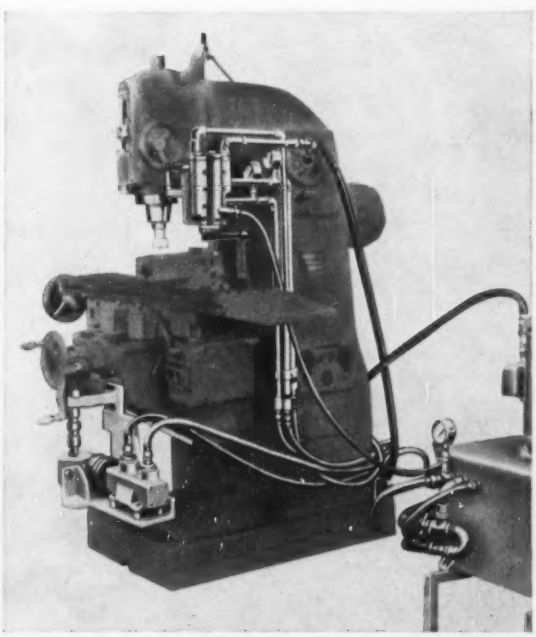
Hydraulic Copying Attachment for Milling Machines

A Bondycop hydraulic copying attachment for milling machines has been introduced in this country by the Morey Machinery Co., Inc., 410 Broome St., New York 13, N. Y. This patented attachment is designed to insure a high degree of accuracy in machining metal parts having complicated shapes, such as turbine blades. It is also adapted for use in machining irregular-shaped surfaces of molded and plastic parts. Both large-production and small-run work can be handled efficiently.

The attachment is easily in-



Profile milling and boring machine announced by Forney's Inc.



Bondycop hydraulic copying equipment applied to milling machine

stalled on any regular milling machine and is obtainable in several sizes. It can be operated by unskilled labor.

Mead Rotary Air Feed for Hand Miller

The Mead Specialties Co., Dept. M-26, 4114 N. Knox Ave., Chicago 41, Ill., has developed a semi-automatic work feeder that is said to save considerable time in feeding brass plugs to the slotting cutter of a hand milling machine. In using this feeder, the operator employs his left hand to move the table feed-lever, while he places the brass plugs on the rotary table with his right hand.

When the operator feeds the table forward by means of the hand-lever, an air line is automatically opened, causing the rotary work feeder to be indexed to the next station. Simultaneously, an auxiliary valve on the work feeder admits air to a midget air clamp at the work station, locking the work-piece in its nest just before it passes under the cutter. When the table is returned to the starting point, it trips a limit valve that shuts off air from the rotary work feeder, making it ready for the next cycle. A cam mounted on the stationary hub of the work feeder ejects the finished pieces into the discharge chute.

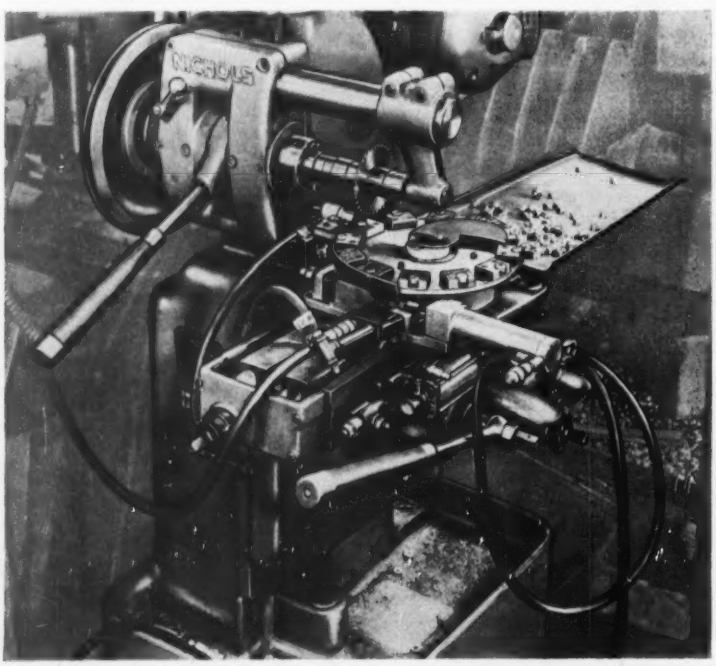
Precisionaire gage equipment for checking pistons

Sheffield Precisionaire Piston Gage

The Sheffield Corporation, Dept. M, Dayton 1, Ohio, has brought out a new type piston gage for simultaneously gaging the piston skirt diameters at two places, the taper from top to bottom, and the cam ground skirt at three points. In measuring the diameter, the Precisionaire gage also indicates in which one of eight classifications the piston belongs.

The gage shown in the illustration is being used where the difference in measurements between one piston class and the next is only 0.0002 inch. The gage consists of a chromium-plated ring containing a number of air jets, two Sheffield "Plunjets," and a five-column Precisionaire gage.

The piston is simply inserted in the gage with the head up. Instantly the position of the floats in the glass columns indicate whether or not the piston is dimensionally correct. The bottom of the piston skirt is checked at points 20 degrees and 90 degrees on each side of the major axis. Taper is measured between the upper and lower skirt diameters by comparison of two float positions. This piston gage is especially suited for use in conjunction with the Sheffield cylinder-block bore gaging and classifying machine. The combination permits selective matching of pistons to bores during assembly.



Mead rotary air feed applied to hand miller

"Qua-Flex" Air Hose

A heavy-duty "Qua-Flex" air hose with braided rayon cable-cord reinforcement to withstand working pressures as high as 450 pounds per square inch, yet remain flexible at temperatures as low as —40 degrees F., as announced by Quaker Rubber Corporation, Division of H. K. Porter Co., Inc., Dept. M, Tacony & Comly, Philadelphia, Pa. This air hose is made in lengths up to 50 feet; inside diameters range from 3/8 inch to 2 inches.

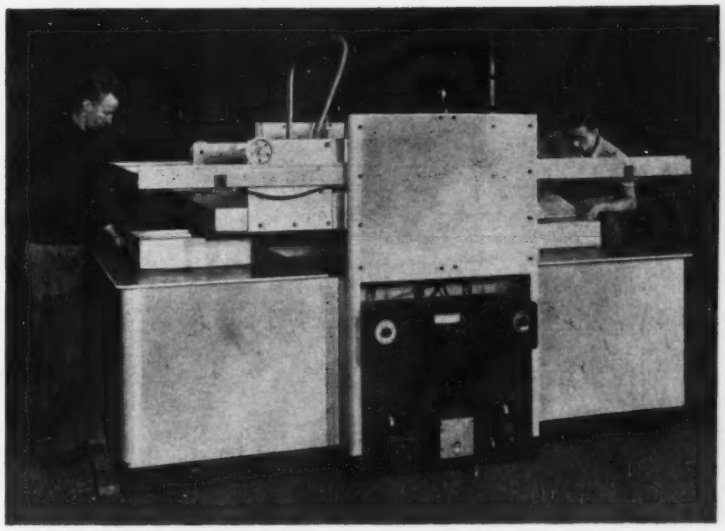
Vacuum Forming Machines For Thermoplastic Sheets

The Auto-Vac Co., Dept. M, 2120 Post Road, Fairfield, Conn., has announced the development of machines for manufacturing a wide variety of products and parts by the vacuum forming of thermoplastic sheets. These machines are said to provide an efficient means for both heating and forming the plastic material.

The vacuum process is relatively simple. It consists of heating a plastic sheet clamped to a mold and then evacuating the space between the sheet and the mold. This has the effect of drawing the thermoplastic sheet into close contact with the mold. On cooling, the formed plastic material retains the shape produced by the mold, from which it can be removed as an essentially finished product.

Polystyrene, modified styrenes, polyethylene, acetate, butyrate, and all vinyl polymers can be shaped or molded by this vacuum forming process. It is being employed extensively in producing objects for display purposes, lighting equipment, medicine cabinets, drainboards, washing machine lids, television and radio cabinets, and precision instrument cases.

Materials varying in thickness from 0.001 to 0.125 inch can be formed without noticeably affecting the basic strength of the material. Machines 17 by 21 inches are recommended for use in the production of many small parts and novelties, while machines 48 by 72 inches are recommended for large parts.



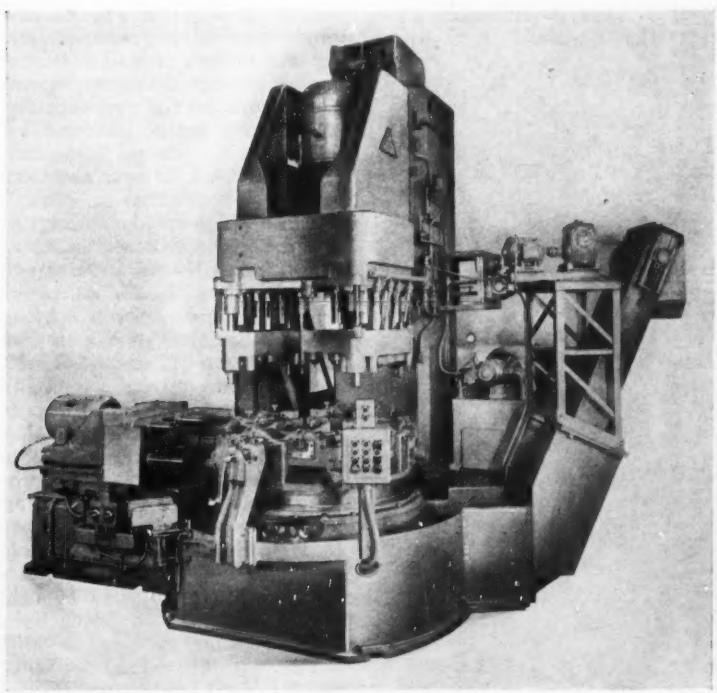
Vacuum forming machine for thermoplastics built by the Auto-Vac Co.

Two-Way Drilling and Counterboring Machine

The LeMaire Tool & Mfg. Co., Dept. M, 2657 S. Telegraph Road, Dearborn, Mich., has brought out a two-way drilling and reaming machine with a four-station hydraulically operated automatic indexing table. This machine is equipped for drilling and reaming right- and left-hand track links for tractors. It has a fabricated base with a hydraulic slide type unit on which a four-spindle drilling head is mounted. At the rear of the base is a vertical column equipped with a slide type hydraulically fed unit carrying a ten-spindle drilling head. At the right-hand side is a conveyor for unloading chips.

The indexing table has four fixtures, each of which holds one pair of right- and left-hand parts. The operator unloads and loads the fixtures at the first station. At the three succeeding stations, the same machining operations are performed on other pairs.

At the second station, two holes are core-drilled in each part by the vertical head and two holes are drilled by the horizontal head, making a total of eight holes drilled in the two parts. One of the core-drilled holes is held to size within minimum and maximum diameters of 1.236 and 1.239 inches, and the other is core-drilled to a diameter of 1.7925 inches. Each of the two holes drilled by the horizontal head is 29/64 inch in diameter.



LeMaire drilling and counterboring machine with automatic indexing table.

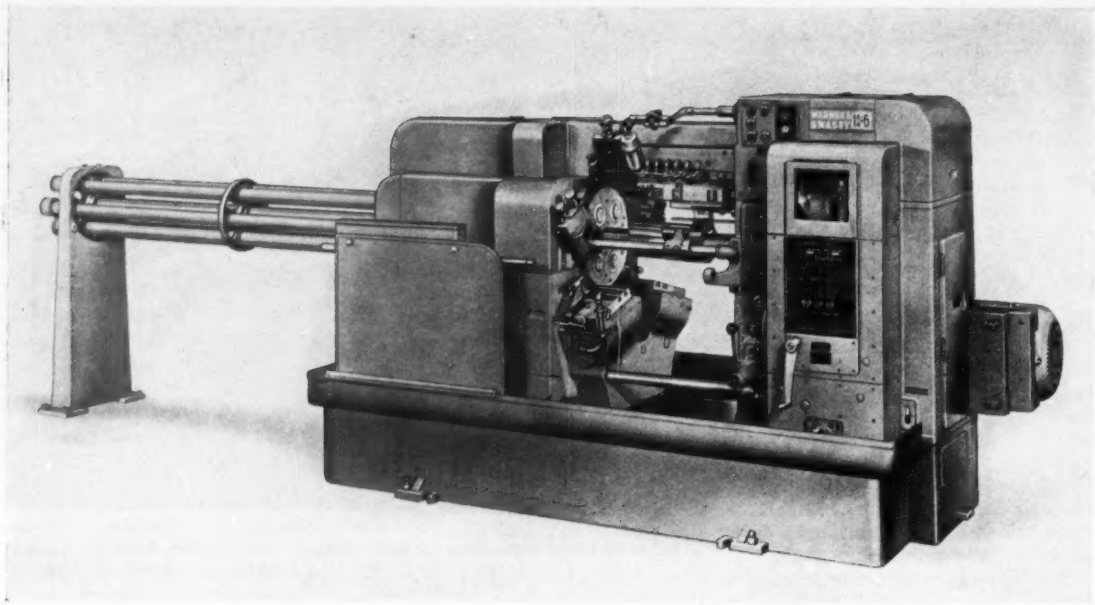


Fig. 1. Six-spindle automatic for small-size work brought out by the Warner & Swasey Co.

At the third station, a 53/64-inch diameter counterboring operation is performed on each part by the vertical head. Finish-reaming of the holes previously core-drilled at the second station is performed at the fourth station by the vertical head, thus completing the cycle of operations on one pair of track links. Production is approximately forty-five pieces per hour.

Multiple- and Single-Spindle Automatics

Automatic multiple-spindle bar machines of 1 1/4- and 3/4-inch capacity have been brought out by the Warner & Swasey Co., Dept. M, 5701 Carnegie Ave., Cleveland 3, Ohio, to extend into a smaller size range the features of larger models introduced by the concern in 1947. These machines incorporate the quadrant mechanism, which eliminates the need for interchangeable cams. Feed strokes are simply set by positioning trip-blocks on calibrated quadrant scales. The same principle is applied to the cross-slide feeds, further simplifying set-up operations.

These machines, one of which is shown in Fig. 1, also incorporate elliptical-eccentric gears for driving the Geneva indexing mechanism to obtain vibrationless operation. Provision for over-indexing the spindle drum, followed by back-indexing about 1/16 inch against a latch, insures shockless indexing and positive clamping.

These high-speed automatics are equipped with six spindles. The spindles have a speed range of from 255 to 2781 R.P.M. in the 1 1/4-inch bar capacity model. The 3/4-inch bar machine has an even higher range—372 to 4045 R.P.M.

The turning stroke is infinitely variable between 0 and 5 inches; standard maximum length that can be turned with multiple cuts is 8 1/2 inches, but special provisions can be made for turning lengths up to 10 inches. The bar feed stroke is infinitely variable up to 10 inches, and the cross-slide stroke from 0 to 13/16 inch.

The machines are driven by a 20-H.P. motor running at 1750 R.P.M. with drive-shaft speeds of 916 R.P.M. (1 1/4-inch model) and 1333 R.P.M. (3/4 inch model). The machines are 11 feet 2 inches

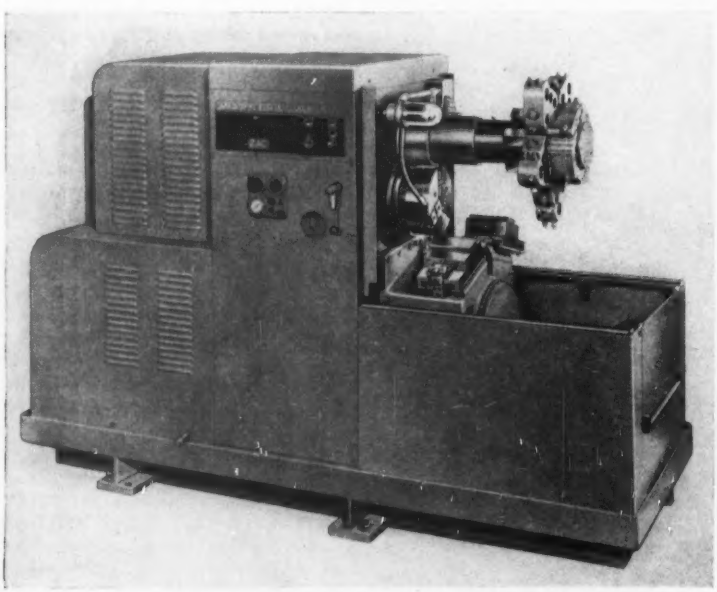


Fig. 2. Warner & Swasey single-spindle automatic developed to handle large-diameter work

in over-all length and 4 1/2 feet in width. A continuous chip conveyor, which moves chips out of the pan through the rear of the machine and deposits them into a bin, is standard equipment.

The Warner & Swasey 2-AC single-spindle automatic chucking machine shown in Fig. 2 is a larger capacity model of the company's 1-AC machine introduced in 1947. Designed for diversified production, the machine has front and rear cross-slides and a five-faced overhead turret. It handles work up to 10 1/2 inches in diameter by 9 inches in turned length.

Trip-blocks are simply positioned in the slots of a pentagonal drum at the rear of the turret shaft to control feeds, spindle speeds, length of cutting stroke, and skip indexing. Either or both cross-slides can be selected to operate with any or all turret faces, and a quick Allen wrench adjustment controls late and dwell cross-slide operation. Cam changes are thus done away with, and set-up is simple.

To insure maximum rigidity, the turret shaft is provided with two large-size enclosed bearings. Because of the overhead turret, the customary tool overhang on larger-diameter work is eliminated. As work diameters increase, tools are brought closer to the guiding ways.

Set-up controls include feed and speed selectors, automatic and hand operation switches, and forward, reverse, and index push-buttons. Operating controls include spindle and coolant control switches, and "cycle start," "motor start," and "stop" push-buttons.

The spindle speeds range from 40 to 1102 R.P.M., and six automatically selected speeds are available in either of two ranges. Thirty-six feeds are available from 0.0019 to 0.124 inch, from which six may be automatically selected.

Portable Electric Arc Welder

A "Royal-Arc" portable arc welder with a capacity range of 15 to 200 amperes has been brought out by the Royal Equipment Corporation, Dept. M, 906 Main St., Burbank, Calif. This flexible all-purpose, all-position welder is light in weight and can be easily carried by hand from job to job. No work is said to be too large or too small for this welder. It is ready to weld any metal up to extra thick steel plate as soon as it is connected to a 110/220-volt alternating-current circuit. An "electronic brain" unit serves to turn on extra heat whenever it is needed. Electrodes in sizes from 3/64 inch to and including 5/32 inch can be used.

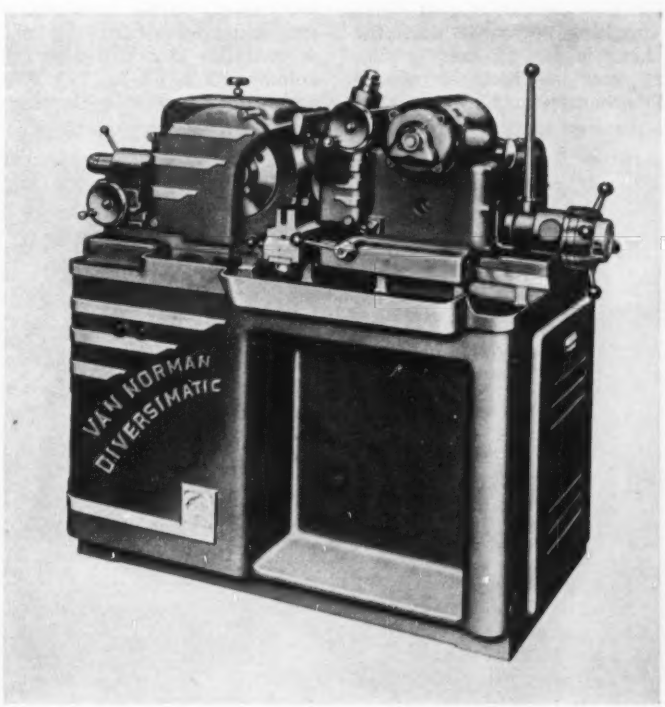
This welder is claimed to be absolutely shock-free, even to the most inexperienced operator. It can be used to weld, braze, solder, cut or preheat with either the metallic arc or carbon arc process. The over-all length is 10 1/2 inches, over-all width 7 inches, depth 6 1/4 inches, and shipping weight approximately 65 pounds.

"Diversimatic" Centerless Grinder

The Van Norman Co., Dept. M, Springfield 7, Mass., has announced the addition of the "Diversimatic" centerless grinder to its line of oscillating radius grinders and production type cylindrical grinding machines. The "Diversimatic" is adapted for grinding a wide variety of parts, such as bearings, bushings, capscrews, shafts, and formed parts having two or more diameters or irregular contours. It is of rugged, precision-built construction and has many features developed to insure rapid production of close tolerance work with fine microfinished surfaces.

The machine has an easily removable grinding wheel with a speed of 1600 R.P.M. and a spindle quill with combined double-row precision ball and roller bearings. These bearings are sealed and lubricated for life, and are said to eliminate the necessity for a "warm-up" period. A combination straight and contour type grinding wheel dresser and a straight screw type regulating wheel dresser are provided. The truing diamond is continuously flushed with coolant during wheel dressing operations.

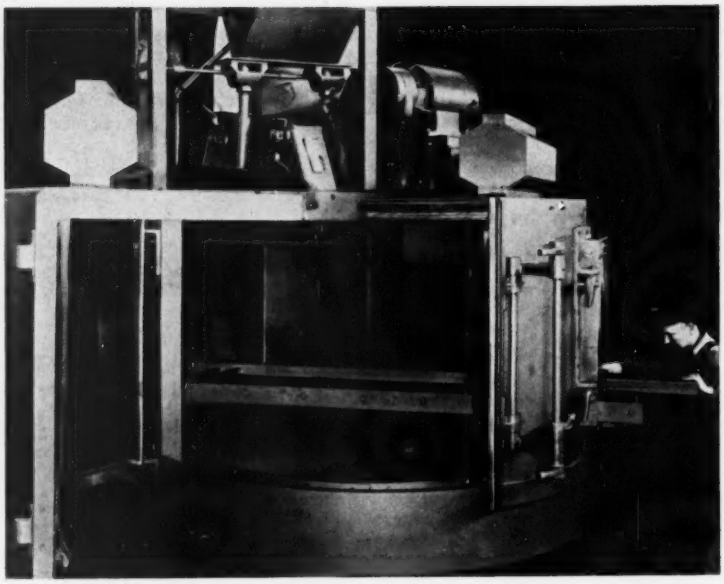
Provision is made for stepless speed changing of the variable 1/4-H.P. regulating wheel drive within a range of 30 to 300 R.P.M. The Acme infeed screw is 1 7/8 inches in diameter and has 4 threads per inch. It has a full length split type nut designed to compensate for wear. An adjustable rest is provided for positioning the work. This rest can be fixed across the ways or made



"Diversimatic" centerless grinder now being marketed by the Van Norman Co.

to feed in and out with the regulating wheel.

Of special importance is the new crush-forming attachment that makes possible extremely accurate grinding of small formed parts that cannot ordinarily be ground between centers due to work deflection. This attachment dresses the wheel face to the contour required for accurately imparting the desired profile to the work. Wheel clearance ranges from 0 to 1 1/2 inches. The machine occupies a floor space 48 by 36 inches.



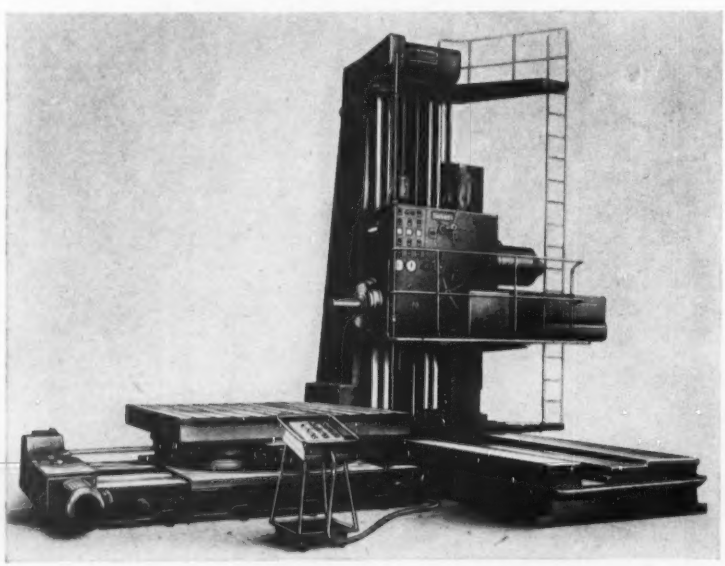
Rotoblast table with access door announced by the Pangborn Corporation

Pangborn Rotoblast Table with Access Door

The Pangborn Corporation, Dept. M, Hagerstown, Md., has announced the addition of an access door to its LK Rotoblast cleaning table. With this accessory it is possible to blast-clean long sections in a table of small diameter—a desirable feature when the usual run of work in the cleaning room is of a certain size range but an occasional larger piece also requires cleaning. Flexible rubber curtains over the access opening prevent the abrasive grit from flying out into the room.

Schiess Boring and Milling Machine

A horizontal boring and milling machine with a spindle 6 1/4 inches in diameter, a gear drive for roughing, and a belt drive for finishing is one of four Schiess heavy machine tools introduced in this country by the Kurt Orban Co., Dept. M, 205 E. 42nd St., New York 17, N. Y. This machine is particularly suited for high-speed machining with carbide tools. It is made in standard sizes with spindles 6 1/4, 7 1/2, 8 7/8, 10 3/8, and 12 3/8 inches in diameter.



Schiess horizontal boring and milling machine introduced in this country by Kurt Orban Co.

An 80-inch double-column vertical boring mill, not illustrated, which incorporates hydraulic preselection of speeds, independent automatic vertical, horizontal, and angular feeds, counterbalanced cross-rail and side-head, and an all-vertical gear drive is the second of the Schiess line now available. Two single-column vertical turret lathes with capacities for turning work 49 and 59 inches in diameter complete the line.

Hayes Rotary Dividing Table

A "wafer-thin" precision rotary dividing table built by Hayes Engineers, Ltd., Leeds, England, for use on milling, drilling, and jig-boring machines is being introduced in this country by the International Machinery Division, British Industries Corporation, Dept. M, 164 Duane St., New York 13, N. Y. Being exceptionally low, the dividing table has the advantage of giving the extra space between the work-holding surface and the tool or cutter that is frequently needed for precision jig-boring, milling, and drilling operations.

The worm for rotating the table is hardened steel and is fitted into an eccentric quill assembly to enable it to be easily disengaged. A positive stop is provided to allow the worm to be re-engaged in the correct position. An accurately divided dull chromium-plated mi-

"Wafer-Thin" rotary dividing head introduced by International Machinery Division, British Industries Corporation

Electronic adjustable-speed drive equipment of improved design brought out by the Reliance Electric & Engineering Co.

crometer dial of large size supplements the divided ring around the periphery of the table.

The dividing table is available in two sizes—11 and 12 inches in diameter. Dividing plates and other accessories can be had for use with the dividing tables.

Wysong All-Steel Cylinder-Forming Rolls

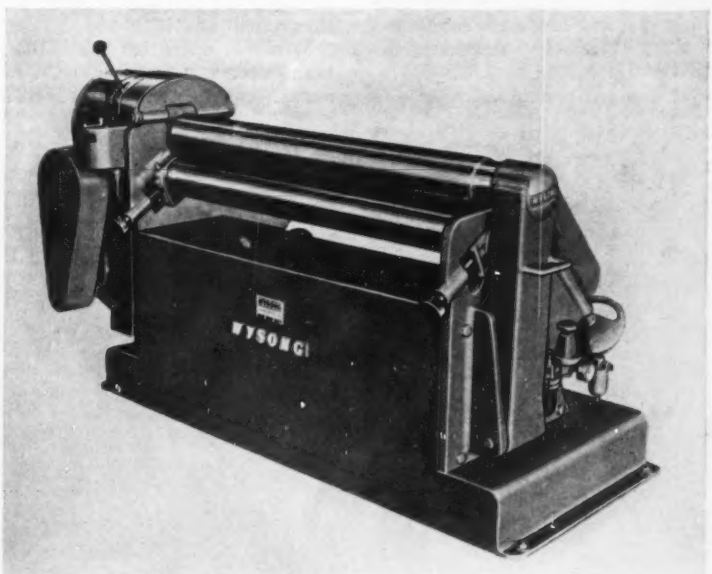
All-steel cylinder-forming rolls are being made by the Wysong & Miles Co., Dept. M, Greensboro, N. C. The frames of these series "C" 5-inch rolls are one-piece, all-steel weldments. The rolls are accurately machined and polished alloy forgings. Each roll is power-driven, and can be grooved to the buyer's specifications. The machine-cut steel gears that drive the rolls run in a continuous bath of oil, and automatically remain in proper mesh at any roll setting.

The bearing housing at the right-hand end of the machine can be dropped to free the top roll so that the formed cylinder can be removed. The drive from the motor to the flywheel is through V-belts. A three-way drum having forward, reverse, and neutral positions controls the drive. Five sizes in the series handle sheets from 36 to 96 inches in width and in thicknesses from 3/16 inch to 16 gage.

Reliance Adjustable-Speed Drives

The Reliance Electric & Engineering Co., Dept. M, 1088 Ivanhoe Road, Cleveland 10, Ohio, has brought out an electronic type variable-speed drive called the "V*S, Jr." This drive is now available in five sizes rated at 3/4, 1, 1 1/2, 2, and 3 H.P. It is designed to meet the needs of the machine tool and metal-working industries for adjustable-speed driving units in the lower power range.

The drive consists of an adjustable-speed drive motor, operator's control unit, and a control unit that receives power from an alternating-current line. Operating speeds range from 270 to 2300 R.P.M., but speeds as low as 75 R.P.M. are available for setting-up



Wysong motor-driven rolls for cylinder-forming work

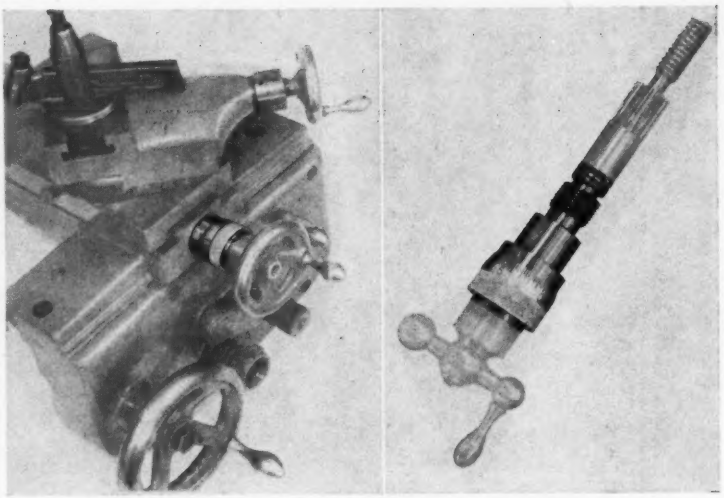
operations, light loads, or intermittent duty.

The drives can be applied to existing machines or installed as built-in units in new equipment such as high-speed drills and cylindrical grinders. Other uses include chain, belt and screw-feed conveyors, test stands, welding tables, press table feeds, and wire-forming machines. A wide range of operating requirements can be met by manipulating the "start-stop" buttons, "jog-run" selector switch, and speed adjuster on the operator's control station.

Huge One-Piece Surface Plate

A one-piece granite surface plate, said to be the largest in the world, has just been completed by the Rahn Granite Surface Plate Co., Dept. M, 641 N. Western Ave., Dayton 7, Ohio. This giant-size surface plate weighs 60,000 pounds and is 20 feet long, 6 feet wide, and 3 feet thick. Inspection of the surface with an auto-collimator in the manner seen in the illustration showed that the over-all accuracy of the entire surface is within 0.0015 inch, and every 6-foot-square section is accurate to 0.0002 inch.

The surface is in the form of a quite uniform convex arc, and is said to be as close to a theoretically perfect plane as it has been possible to attain in such large size up to the present time. It is possible that any large object placed on this surface will conform to the uniform curvature, making possible measurements that are accurate to 0.00005 inch over the entire plate.



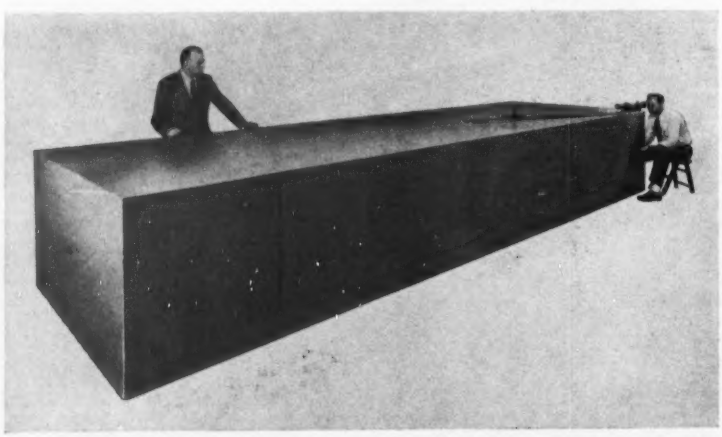
Lathe cross-slide seen at left is equipped with "Microturn" attachment shown at right

"Microturn" Dial-Feed Attachment for Lathe Cross-Slide

A dial feed attachment for lathe cross-slides, called the "Microturn," which is said to enable unskilled operators to produce extremely accurate work on ordinary shop lathes, has been developed by the L. G. Arpin Co., Dept. M, 261 Hurlbut St., Orange, N. J. This attachment, shown at the right in the illustration, can be installed on the cross-slide as shown in the view at the left without altering the lathe. Repeated cuts of 1/2 inch for a diameter reduction of 1 inch have been made on 1040 steel with this attachment. Vertical and horizontal loads are carried on needle and thrust ball bearings.

While in operation the "Microturn" does not depend on the accuracy of the cross-feed screw, which merely serves as a connecting-rod between the unit and the cross-compound, but instead depends on its own 3/4–80 pitch thread which has been machined to exceptionally close tolerances. As the dial of the attachment is turned, the tool position is advanced or retracted by the action of the 3/4–80 thread within its mating part.

The attachment coupled with the normal feed-screw enables the operator to adjust the machine rapidly for rough readings using the normal lathe procedure, and then makes it possible to adjust the final readings to within 0.0001 inch. At present the "Microturn" attachment is being manufactured for several makes of lathes in the 9- to 13-inch size range.

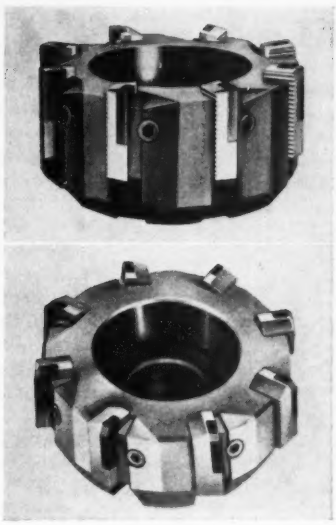


Rahn one-piece granite surface plate said to be largest ever produced

Shell End-Mills with Inserted Carbide Blades for Machining All Metals

The Super Tool Co., Dept. M, 21650 Hoover Road, Detroit 13, Mich., has recently added inserted-blade shell end-mills for steel, cast iron, and non-ferrous metals to its line of carbide metal-cutting tools. The blades of these cutters are of serrated-back design with carbide tips. They are secured in their shell holders with minimum stress by wedges that distribute the holding pressure along the entire length of the blade, and are quickly replaceable.

The cutter shown in the upper view of the illustration is for mill-



Inserted-blade carbide shell end-mills made by Super Tool Co. for machining metals

ing cast iron, and the one in the lower view is for steel. The cutters for steel are designated Type DBSS, and are available from stock in diameters of 4, 5, 6, and 8 inches, and for cast iron in stock sizes from 3 to 8 inches, inclusive. Replaceable blades are also stocked for both cutters in suitable carbide grades.

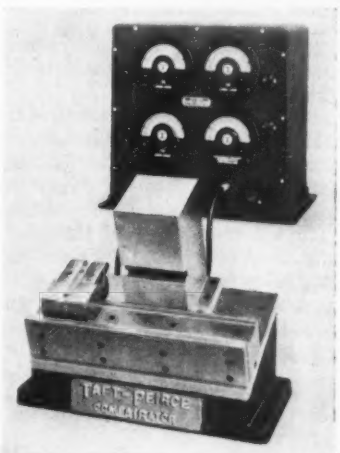
Speed-Changing Unit for Drill Press

A "Vari-speed Changer" which enables the operator to change speeds quickly and with a minimum of effort by simply releasing a toggle-action lever and slipping the belt to the proper pulley step has been brought out by Boyd Machine, Inc., Dept. M, 711 E. Fourth St., Royal Oak, Mich. This unit is designed to fit any 17- to 20-inch drill press and provides for speed changes from 125 to 4000 R.P.M. with a motor running at a speed of 1725 R.P.M.

The "Vari-speed Changer" has a heavy cast-iron frame and uses the belt regularly supplied with the drill press. It does not interfere with the guard and is supplied with pulleys and second belt.

Taft-Peirce Air Gage for Jet Blades

The Taft-Peirce Mfg. Co., Dept. M, Woonsocket, R.I., has completed an air-operated gage for use in inspection of the root sections of jet-engine turbine blades. In gaging serrations in the root section



Air gage for inspecting jet-engine blade root sections made by Taft-Peirce Mfg. Co.

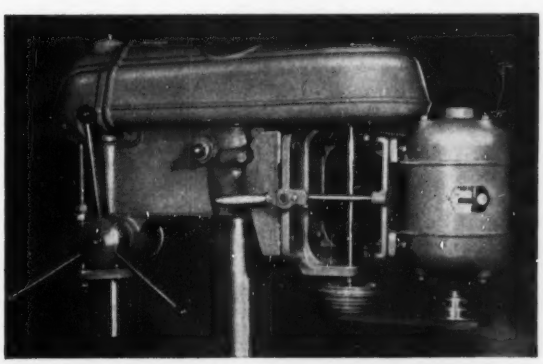
of the jet blade, measurements are taken over tungsten-carbide contact rolls that are properly positioned in the serrations. The contact rolls are precision-ground to the correct measuring size, and are mounted on parallel reeds so that they are free to move vertically and horizontally. This permits the rolls to position themselves correctly, regardless of any permissible variations in lead that may exist in the serrations.

Three air indicators, with dial graduations of 0.0001 inch, show the dimensions as measured over the rolls on each of the three serrated sections. In addition, a new Taft-Peirce computing indicator incorporated in the gage computes automatically the difference between the amounts that each of two dimensions varies from its mean value. The inspected part is rejected whenever the computing indicator shows this variation to be greater than plus or minus 0.001 inch. This two-point contact also facilitates complete end-to-end inspection of slots for taper.

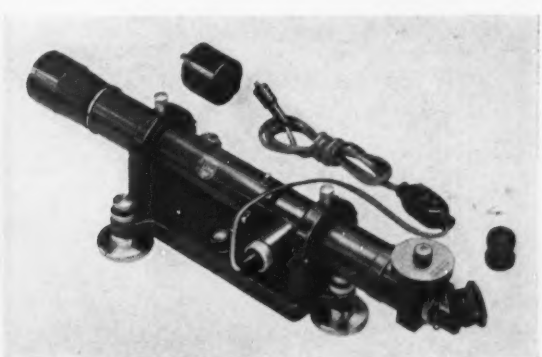
The air gaging unit illustrated is so designed that a grinding machine operator can gage the part while it is still in the grinding fixture, thereby eliminating costly rejects. A second unit of similar design has been built for use as a final inspection gage in checking the finished part. With this gaging equipment, an inspector can determine the exact value of the dimensions in a few seconds. No special operator skill is required.

Improved "Microptic Auto-Collimator"

An improved "Microptic Auto-Collimator," designed for testing straightness, squareness, and parallelism to an accuracy of 0.0000025 inch per inch, has been announced by the Engis Equipment Co., Dept. M, 431 S. Dearborn St., Chicago 5, Ill. This instrument serves as the



Drill press equipped with "Vari-speed Changer" brought out by Boyd Machine, Inc.



"Microptic Auto-Collimator" introduced by the Engis Equipment Co.

equivalent of an independent super-precision level and is unaffected by temperature changes, normal shop vibration, or wear. It is said to give readings comparable to those of a level having forty times the normal accuracy and can be used in a horizontal, vertical, or inclined position. With the addition of an optical right-angle accessory, this instrument can be used for checking in a direction perpendicular to its own axis.

A 4-volt illumination unit with a 12-foot cord, switch, and plug; a transformer for standard light outlets; and a filter designed to give sharper and clearer readings are some of the improved accessories of the instrument. A circular bubble in the base permits quick leveling when necessary. An accurately lapped leveling pad is also located on the base.

Supports for leveling screws insure steady positioning when making adjustments. An improved scale that permits determining inclinations in two perpendicular planes without rotating the instrument in its bearing is included. An angular eye-piece that can be rotated through the full circle for greater convenience of the operator is optional. New methods for quick, convenient setting of reference mirrors, even at a considerable distance, can be employed with this equipment.

Besly-Bowen Radial Head Face Grinders

The Besly-Welles Corporation, Dept. M, Beloit, Wis., has just built seven new type Besly-Bowen radial head face grinders designed for use in the production of highly accurate parts that can be ground only on one side at a time. These grinders have two rotary work stations and an automatically controlled working cycle that permits continuous grinding at high production rates. Four of these machines are equipped for grinding parts of automotive power steering equipment. The other three machines grind automatic transmission parts.

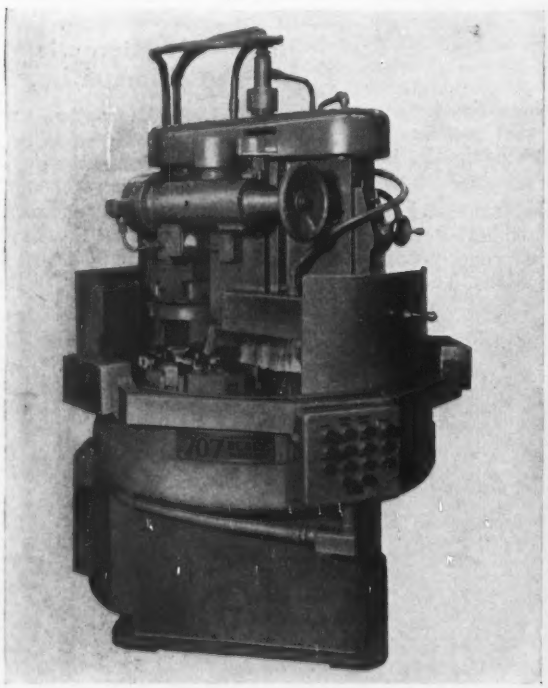
In operating these grinders, the automatic cycle is started over one rotary table, leaving the operator free to unload, clean, and reload the alternate table. At the completion of the cycle, the grinding head is indexed over the second table where the grinding cycle is repeated. Easy operation and adaptability for grinding a broad range of parts made from many different materials are important features of these machines.

Basically, the grinders in this line consist of a unique balanced head assembly and a supporting base and column. The head assembly, which carries the abrasive wheel and spindle drive, can be rotated around the central supporting column and indexed radially, oscillated, or held in a fixed position. It can also be adjusted up or down by a micrometer feed-screw which has a direct-reading dial. The base has a large circular surface on which work-holding fixtures can be located directly under the grinding head.

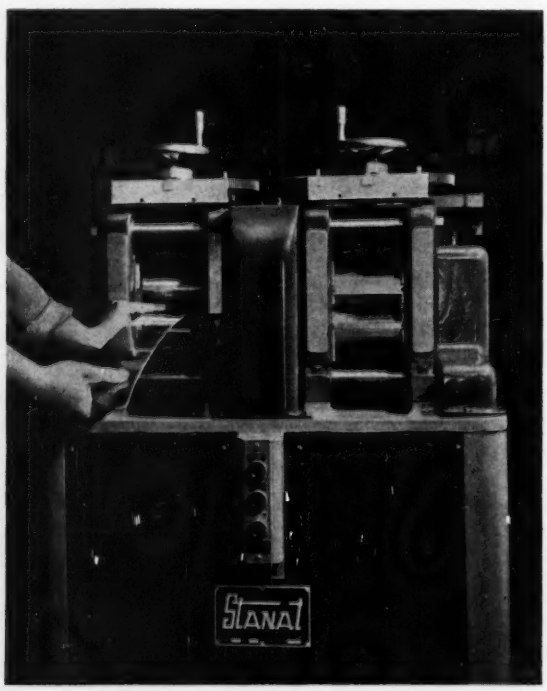
Each automatic cycle is a precise duplicate of the preceding one, assuring uniform production and accurate dimensional control. This is made possible by a single-cycle cam, designed to feed the abrasive wheel to the work in a controlled pattern that is exactly suited to the work being ground. These machines are built in three sizes having base diameters of 36, 49, and 66 inches. They weigh 1300, 5000, and 10,000 pounds.

Stanat Small Rolling Mills

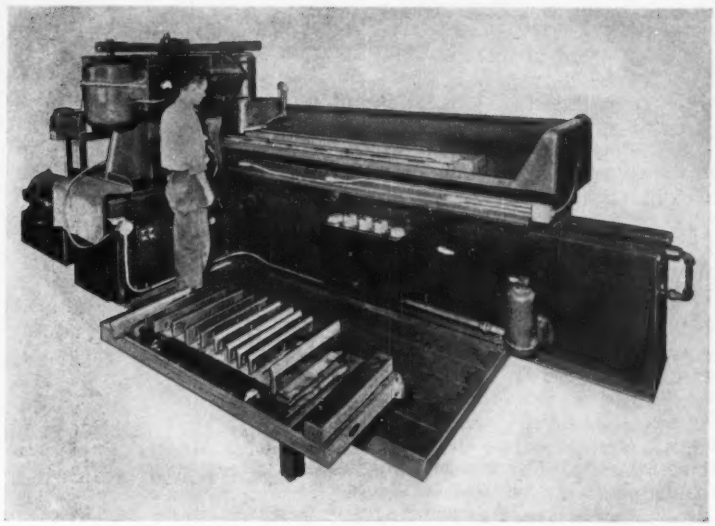
Ruggedness and versatility were the main objectives for a line of 3- and 4-inch rolling mills



Radial head face grinding machine recently built by the Besly-Welles Corporation



Small-size rolling mill has been introduced by the Stanat Mfg. Co.



"Cleveland" hydraulic knife grinder placed on the market by the Hill Acme Co.

developed by the Stanat Mfg. Co., Dept. M, 47-28 37th St., Long Island City 1, N. Y. These mills incorporate features previously associated only with heavy rolling mill equipment. By using standard, interchangeable parts, units can be assembled or adjusted to meet individual requirements. Flat or grooved rolls can be furnished to produce a great variety of bar stock shapes, including round, square, half-round, diamond, or special shapes.

For hot-rolling, the machines can be equipped with water-cooled rollers; for engraving, with special rollers. They are already in wide use in the manufacture of small machine parts, jewelry, slide fasteners, and tubular heating units as well as for many other applications where small parts with fine tolerances are required. They can also be used to test the properties of such materials as stainless steel, plastics, titanium, etc. Compact design permits use in limited space.

Struthers Wells Press Brake

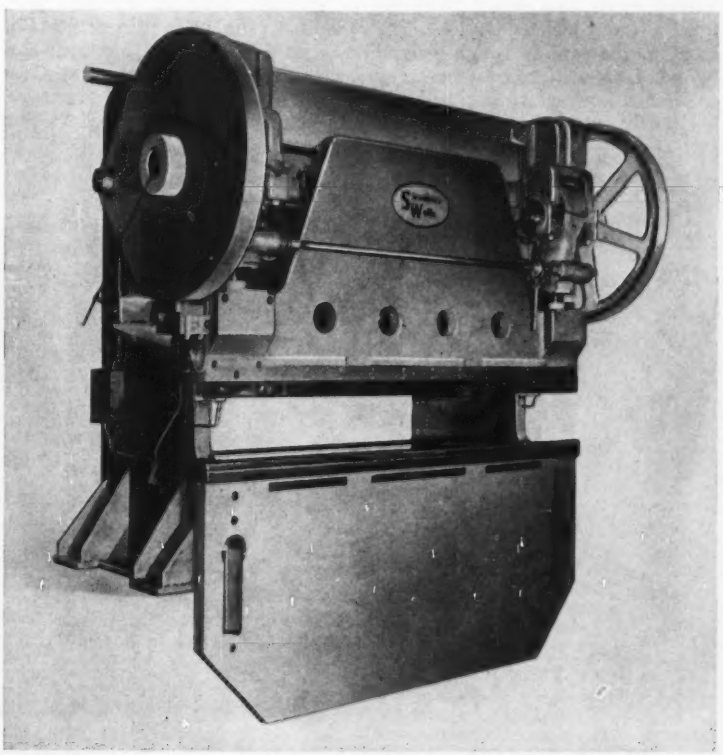
The Struthers Wells Corporation, Machinery Division, Dept. M, Titusville, Pa., has recently added a Model 400-PB-8 press brake to its line of sheet-metal forming equipment. This machine has a capacity of 400 tons, and will form steel sheets up to 3/4 inch in thickness and 8 feet in width.

A pneumatic clutch and a separate brake provide means for instant stopping of the press ram at any point in its stroke. Operating controls for cycling and inching and for obtaining a single work stroke with return of the ram to the "up" position are also included in the press equipment.

"Cleveland" Hydraulic Knife Grinder

The Hill Acme Co., 1203 W. 65th St., Cleveland 2, Ohio, is introducing a "Cleveland" hydraulic knife grinder designed to grind straight and concave bevel surfaces at any angle. This machine will also grind straight flat surfaces within its capacity range. It is particularly recommended for sharpening alloy-steel machine knives, including metal-cutting shear blades. The wheel-head of this machine can be tilted at an angle from the vertical position for bevel grinding, and is provided with an instantly variable hydraulic cross-feed. The reciprocating movement of the grinder table is obtained by a hydraulic drive consisting of two opposing pistons which are operated at a low pressure to obtain a smooth and positive movement. The table movement is instantly variable up to a speed of 100 feet per minute.

The working surface of the grinder table is 12 inches wide. The machine can be furnished with a table of any length from 60 to 240 inches. The Hill quick-acting abrasive wheel chuck used on this grinder is 18 inches in



Press brake added to line built by Struthers Wells Corporation

diameter, and is designed for holding six standard abrasive segments 7 1/4 by 1 3/4 by 6 inches. A large-capacity coolant system is provided for wet grinding that includes a motor-driven pump, piping, and ample size storage tank with baffle plates for filtration. The spindle is driven by a 20-H.P. motor equipped with an ammeter, or power calibrator. The hydraulic pump is operated by a 5- or 7 1/2-H.P. motor. The coolant pump and the lubrication pump are individually driven by 1/3-H.P. motors. Standard across-the-line starters are supplied with push-button controls.

Prosser Precision Tool Grinder

Thomas Prosser & Son, Dept. M, 120 Wall St., New York 5, N.Y., has announced the addition of a moderate-priced precision grinder to its line of tool-grinding equipment for use on all types of carbide, Stellite, and high-speed steel cutting tools. The tool to be sharpened is rocked back and forth across the entire wheel face, eliminating scoring and grooving of the wheel.

All settings for grinding front, side, and top angles can be made precisely in both vertical and horizontal planes. The feed of the tool toward the grinding wheel is accurately controlled by a micrometer feed-knob having 0.001 inch graduations.

One side of the grinder is provided with a quick-acting indexing table, which can be set to the required angle and which remains fixed without locking devices. The tools can be rapidly rough-ground by hand on a vitrified wheel (or a diamond wheel if desired), to a slightly greater angle than the final finish angle, and then only a slight amount of grinding is necessary on the finishing wheel, using the precision reciprocating-action tool-holder, to obtain exact angles, straight edges, and a fine finish. A vitrified or diamond finishing wheel can be used, as desired. Accessories for grinding radii, chip breakers, drills, etc., are available.

Tramrail Cantilever Carrier for Handling Work Around Pillars

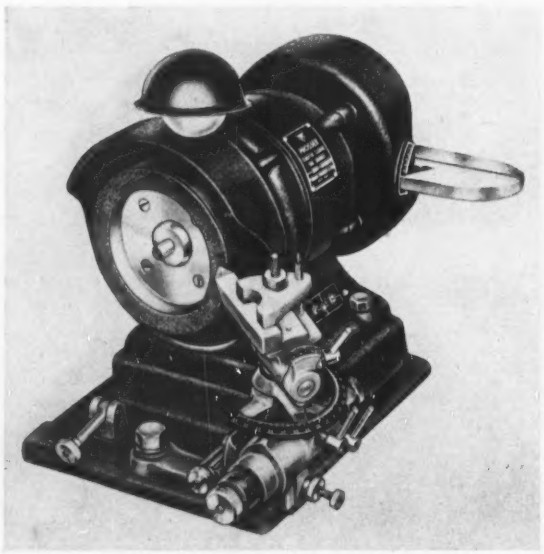
A new type overhead carrier with a cantilever arrangement that permits the unit to handle loads beyond the end of the crane on which the carrier operates has been developed by the Cleveland Tramrail Division of the Cleveland Crane & Engineering Co., Dept. M, Wickliffe, Ohio. This carrier was designed especially for handling materials in areas between roof-supporting pillars that cannot normally be covered by cranes, and, also for reaching through doorways.

The extension feature of the carrier seen in the illustration, permits the hoist to reach out as much as 25 1/2 inches beyond the end of the crane. When it is necessary to travel the crane for some distance on its runway, the carrier is moved from the crane end to permit safe clearance for the columns. This unit has a capacity of 1500 pounds, but other cantilever carriers of different load capacities and reach can be made to suit conditions.

Bakewell Master Toolposts and Tool-Holders

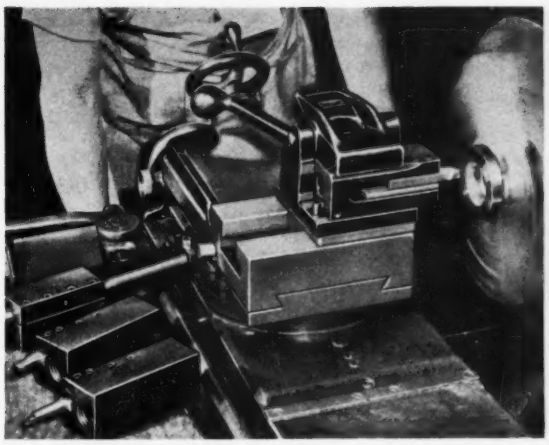
Quick gripping and releasing are features of master toolposts and tool-holders developed by Bakewell Products, Dept. M, 1128 Mission St., South Pasadena, Calif., to reduce setting-up and machining time. A T-block that fits into the T-slot of the lathe compound rest or carriage secures the toolpost to the lathe. Simple riser plates for vertical spacing make it possible to adapt this equipment to any lathe.

The bar type tool-holder is held in the toolpost by hardened and ground jaws. Rotating the operating handle clockwise releases the extreme pressure on the jaws. Further rotation engages a cam that opens the jaws to their full capacity. This permits quick

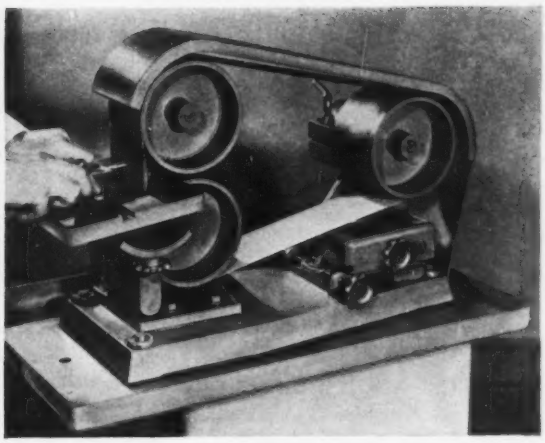


A tool grinder that was recently brought out by Thomas Prosser & Son

Cleveland Tramrail cantilever carrier designed to handle work beyond end of crane



Quick-change toolpost and tool-holders that have been placed on the market by Bakewell Products



Abrasive belt machine developed by the Minnesota Mining & Mfg. Co. and Hammond Machinery Builders

changing of tool-holders. Tightening the tool-holder in the toolpost is accomplished by a counter-clockwise movement of the operating handle. This cam action causes the jaws to grip the tool-holder. A pressure of 10 pounds on the handle then exerts 6200 pounds of jaw pressure on the tool-holder through a screw thread action.

Use of a number of tool-holders makes bench set-ups possible for quick insertion in the toolpost when needed. It also makes possible an almost unlimited number of operations for one lathe set-up. For example, deep boring can be done by simply using a longer quill. A positive stop in the toolpost assures accurate positioning of each cutting tool.

Abrasive Belt Machine for Finishing Carbide Tools

An abrasive belt machine designed to apply a new method of finishing carbide tools is a recent joint development of the Minnesota Mining & Mfg. Co., Dept. M, 900 Fauquier St., St. Paul, Minn., and Hammond Machinery Builders, Inc., Dept. M, Kalamazoo, Mich. This Model 454 machine (manufactured and sold by the latter company) employs abrasive-paper belts developed for sharpening carbide cutting tools.

The tool sharpening method consists of first rough-grinding on a standard grit 60 silicon carbide wheel, and then finishing the sides and top of the carbide tip on the belt machine, using a "Tri-M-Ite" Resinite 4- by 54-inch abrasive belt, with the grit size ranging from 60 to 150 depending on the edge required. A land 1/16-inch wide is finished below the cutting edge. This land is finished to the desired clearance angle and is flat, not hollow-ground.

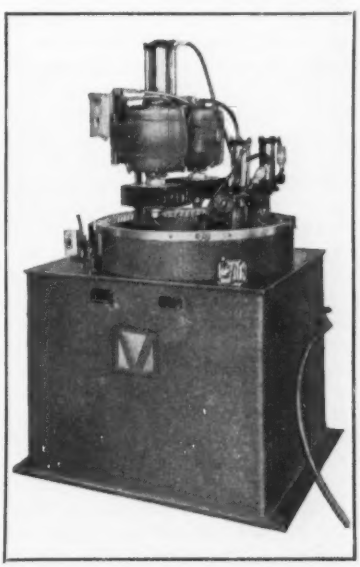
The machine employs the same type calibrated tilting table as Hammond diamond wheel grinders, which is designed to swing out of the way for quick belt replacement without disturbing the angular setting. Other features are a tungsten-carbide-faced platen for flat surface finishing, a 10- by 7 1/2-inch work-table with side supports for sharpening angular tools, a positive abrasive belt tensioning device, and adjustments for both angular and lateral belt tracking. The unit is powered by a 1/2-H.P. single- or three-phase 110- to 440-volt motor.

The finishing machine can also be used for sharpening tools made from high-speed steel and other alloys, and for chamfering and surfacing operations in the machine shop as well. It is also designed for wet-grinding operations with conventional waterproof abrasive belts. An especially compounded stick coolant is available for use with this equipment.

Machine for Deburring Ring Sections of Jet Engines

A turntable type machine for rapid deburring of compressor stator rings, half rings, or other ring sections of jet turbines, has been developed by the Grinding & Polishing Machinery Corporation, 2530-G Winthrop Ave., Indianapolis 5, Ind. Provision is made on this machine for holding ring sections to very accurate diameter measurements during the deburring operation by using interchangeable holding fixtures of the correct diameters to suit the work. Modifications of this design can be readily adapted for deburring other circular workpieces.

A complete time cycle of only one minute for loading, deburring, and unloading is required for a pair of aluminum half-rings having a diameter of 32 inches. Previous hand methods of deburring required an eight-hour day for a set of twenty-four half-rings, whereas this machine does the work in twelve minutes.



Machine for deburring ring sections for jet engines built by Grinding & Polishing Machinery Corporation.

Welding Machine with Arc Voltage Control

A lightweight sigma (shielded inert-gas metal-arc) welding machine with arc voltage control, designated the SWM-3, has been announced by the Linde Air Products Co., a division of Union Carbide and Carbon Corporation, Dept. M, 30 E. 42nd St., New York 17, N. Y. The voltage control is said to eliminate all welding difficulties that are due to a fluctuating arc voltage. Electronic controls maintain the proper balance of welding conditions by instantaneously speeding up or slowing down the rate at which the welding wire is fed as required by changing arc conditions. This precise control over welding variables results in smooth, uniform welds. The electronic control unit does not have to be moved with the welding machine from one job to another but can be permanently mounted anywhere, as long as it is properly connected to the welding machine.

Fig. 1. Linde welding machine in which welding wire is fed automatically from the reel through nozzle

After pre-setting the welder for the required voltage and throwing the starting switch, a retract starter built into the electronic control unit causes the welding wire to be fed down until contact is made with the work. The wire is then automatically retracted, drawing an arc, after which the wire feed is reversed a second time and fed down, maintaining the pre-set arc voltage. Thus the welder is practically self-operating. It can be moved from job to job by one person, and can be mounted on a wall, post, or machine carriage for the mechanical handling of many welding jobs. The machine can be used to fabricate most commercial metals in almost any joint design. Butt, lap, fillet, and corner welds can be made in aluminum alloys, stainless steels, carbon steels, deoxidized copper, Everdur, and aluminum bronze in thicknesses from 16 gage. Welding wires of 1/32 to 3/32 inch in diameter can be used.

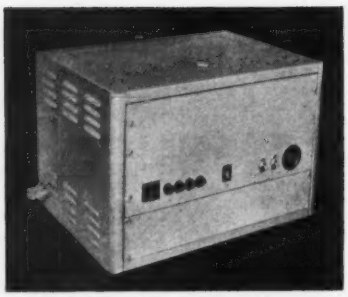
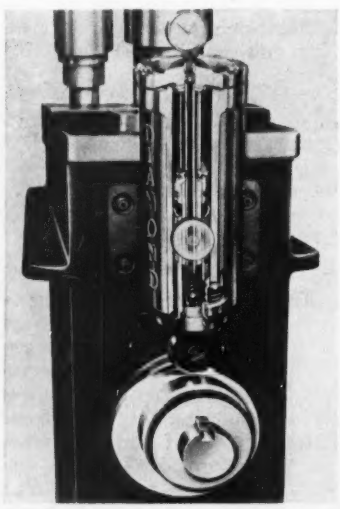


Fig. 2. Electronic "brain" unit that controls welding arc voltage of welder shown in Fig. 1

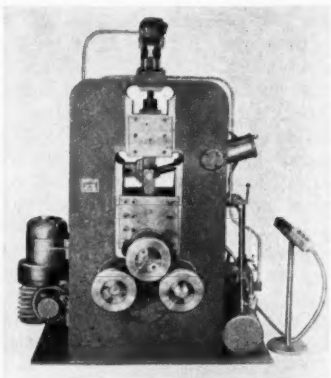
Pneumatic Clutch "Equilibrator"

The Diamond Machine Tool Co., Dept. M, 5111 Coffman-Pico Road, Pico, Calif., has announced a clutch "equilibrator" that is now being furnished as standard equipment on their line of "Multi-Max" punch presses and shears. The "equilibrator" is a two-part unit consisting of a heart-shaped cam and an air chamber with an automatic pumping and regulating mechanism. This device, as used on punch presses, counterbalances the variable punch- and die-plates, which vary from one set-up to another; acts as a frictionless brake; and removes all the load from the clutch assembly at the time of disengagement.

The heart-shaped cam is installed on the crankshaft and is secured to the face of the brake-drum. A roller rides on the surface of this cam, counterbalancing the ram weight. On the up stroke of the ram, the roller pressure on the surface of the cam serves to rotate the crankshaft approximately 5 degrees ahead of the bull-gear wheel. At the point of clutch disengagement this pre-rotation eliminates all drag and pressure on the clutch dog, and enables the clutch to be engaged and disengaged with a feather-light touch.



Diamond clutch "equilibrator" applied to "Multi-Max" punch press



Improved rolling machine announced by the Wallace Supplies Mfg. Co.

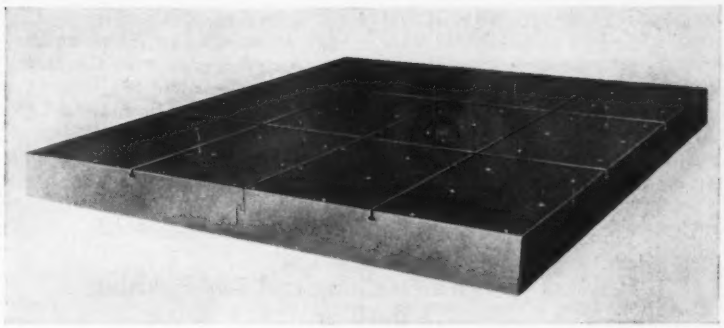
Wallace Rolling Machine for Pipe and Tube Bending

A rolling machine for pipe and tube bending, made up of rolled steel plates and sections, electrically arc-welded and with all welds stress-relieved, has been introduced by the Wallace Supplies Mfg. Co., Dept. M, 1300 Diversey Parkway, Chicago 14, Ill. Push-button controls are mounted on a pedestal stand connected to the machine with a flexible steel cable. Maximum bending capacities, depending upon the size of the machine, are pipe or conduit 1 1/4 to 3 1/2 inches and steel tubing 1 3/4 to 4 inches, outside diameter.

When the initial setting of the bending roll is completed, re-

indexing is accurately controlled by a hydraulically actuated toggle mechanism. After having once been set to produce a given radius, the bending roll may be raised and lowered by hydraulic power without disturbing the initial setting.

A pitch roll attachment provides an easy means of forming a coil of desired pitch. The initial bend can be started anywhere along the length of the material.



Floor-plate with provision for leveling built by the Challenge Machinery Co.

Automatic Machine for Painting Inside of Rocket Heads

A rotary indexing type machine designed for automatic production painting of the inside of rocket heads has been developed by the Conforming Matrix Corporation, Dept. M, 342 Factories Bldg., Toledo 2, Ohio. This machine can be entirely air-operated. If required, however, it can be actuated by a Geneva motion mechanism driven by an electric motor. The machine illustrated has twenty-four work-holders and indexes twelve times for each revolution of the table, painting the inside of rocket heads two at a time.

The painting of the 8-inch deep cavity is done on the return stroke while the work is being revolved by a variable-speed drive. The stroke and indexing speeds are regulated by dials to paint from 400 to 1200 pieces per hour, two at a time. The machine operates in conjunction with a continuous, circulating paint system, and if required it can be supplied with hot-spray equipment. This machine is built for four-, six-, eight-, twelve-, or twenty-four-station indexing or for continuous movement.

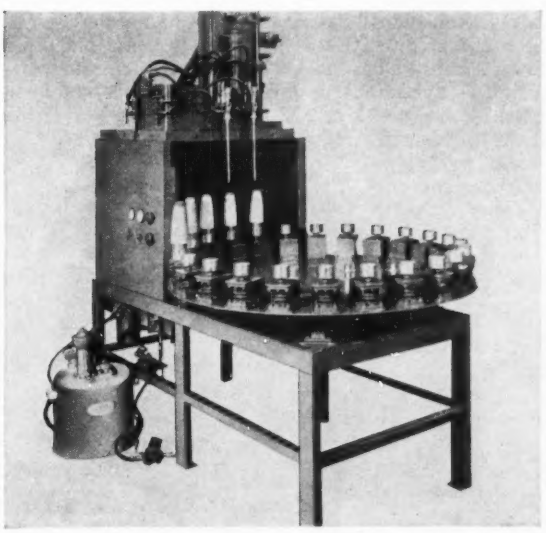
Challenge Adjustable Floor-Plates

Adjustable floor-plates have been added to the line of precision equipment built by the Challenge Machinery Co., Grand Haven, Mich. They provide an accurate and substantial plate that can be placed directly on the floor without any superstructure and leveled by means of hardened screws located around the edge of the plate and at each intersection of the ribbing. All adjusting screws are secured in position by locking screws. The holes above the screws are covered by caps. Three special wrenches are provided for making the adjustments.

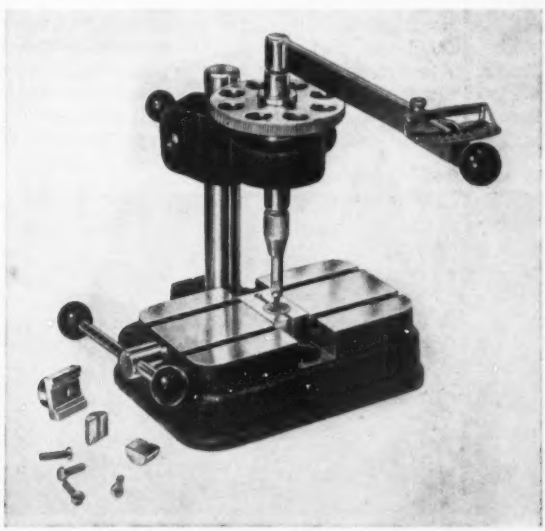
The floor-plates can be furnished as single units up to 54 inches wide and 144 inches long. Larger floor-plates are made up of sections interlocked in one complete assembly. Each section of the assembly can be used individually or in any combination with the other sections.

Torque-Testing Fixture

The P. A. Sturtevant Co., Dept. M, Addison, Ill., has announced a universal torque-testing fixture designed for a wide range of practical uses, such as determining the ultimate strength of screws, testing purchased or manufactured pieces where torsional strength is an important factor, and controlling the torque applied in driving screws or assembling parts to pre-



Machine developed by Conforming Matrix Corporation for automatic spraying of rocket-head cavities



Torque-testing fixture made by P. A. Sturtevant Co., equipped for testing ultimate strength of a screw

vent spoilage or breakage. It can also be used to check the thread-cutting qualities and strength of taps. The fully adjustable spindle is set in instrument bearings and permits rapid engagement of the driver with a wide variety of torque wrenches.

The driving end of the spindle is threaded to take drivers made for special applications as well as regular sockets, socket screwdrivers, etc. A T-slot base facilitates fastening nests and holders to the fixture. Internally threaded collets, collet holder, and drivers for all screws are available for use with this fixture, which is made in capacities of 0 to 200 inch-pounds and 0 to 150 foot-pounds.

Bench Type End-Finishing and Rod-Pointing Machine

A bench type machine designed for pointing steel rods, reaming, boring, and facing tube and pipe ends, drilling bar stock, and chamfering or forming rod ends has been built by the Pines Engineering Co., Inc., Dept. M, 601 Walnut St., Aurora, Ill. The machine is equipped with an electrically controlled air cylinder which actuates the work clamping and feeding mechanisms. Depressing a foot pedal of the electrical control starts the automatic clamping and feeding cycle.

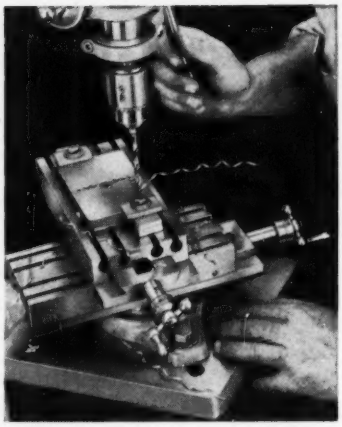
The work is fed to rotating cutters held in the main spindle behind the chuck jaws. When the pointing operation is completed, the chuck automatically returns the work-piece and releases the clamps. The operator's hands are thus left free at all times for faster stock handling and loading. Multiple cutters reduce the time required for the machining cycle. In addition, an automatic swing type stock stop facilitates fast positioning of the work in the open chuck jaws. An adjustable stop-screw controls the forward travel and depth of cut.

The bench-mounted machine illustrated handles any length of stock in diameters up to 2 inches. It weighs 170 pounds, is equipped with a 1/2-H.P. motor, and a two-step sheave that furnishes eight different speeds ranging from 760 to 3920 R.P.M. Larger machines with capacities for heavier work up to 5 inches in diameter are also available.

Universal Table for Drilling and Milling Machines

To facilitate taking combination angular and straight-line cuts on shapers, milling machines, and grinders, the South Bend Lathe Works, Dept. M, South Bend 22, Ind., has brought out a universal table of the design shown in the illustration. When mounted on a drill press, this table can be used to accurately space drilled holes. By simply placing an end-mill in the chuck, the drill press is converted into a light milling machine. If the universal table is mounted on the faceplate of a lathe, spaced holes for jigs and die-blocks can be bored with micrometer accuracy.

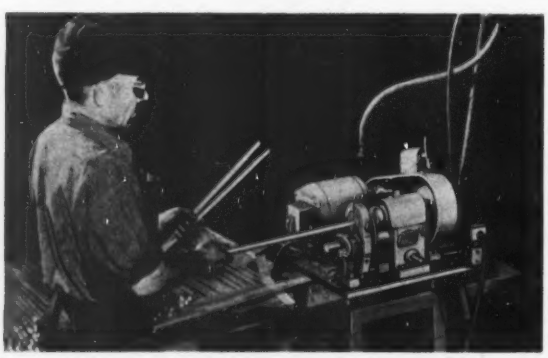
The upper and lower tables are identical, and the upper table can be removed when not needed. Both the upper and lower slides have a maximum travel of 4 inches and revolve on graduated swivels through 360 degrees. The slides can be used without graduated swivels to reduce the height if desired. The two feed-screws are equipped with micrometer collars reading in 0.001 inch. Each precision-ground work-table is 4 inches wide by 8 7/8 inches long and has four slots for clamping bolts. Full-length take-up gibs are provided for the dovetail slides.



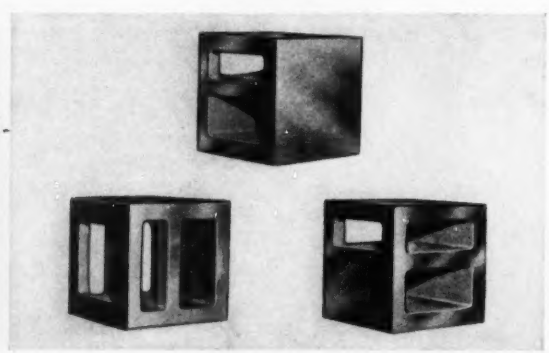
Universal table brought out by the South Bend Lathe Works

Challenge Universal Box Angle

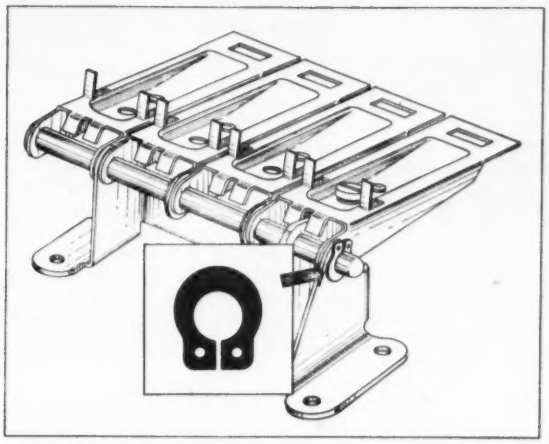
The Challenge Machinery Co., Dept. M, Grand Haven, Mich., has developed a universal box angle that can be used on a wide variety of work. This box angle has been designed to incorporate the clamping facilities of an angle-iron, the stability, balance, and accuracy of a box parallel, and the perpendicular flat surface of an angle-plate. It is made of heat-treated semi-steel with a precision-ground finish in two sizes—6 by 6 by 6 inches and 8 by 8 by 8 inches. Other sizes will be made to order.



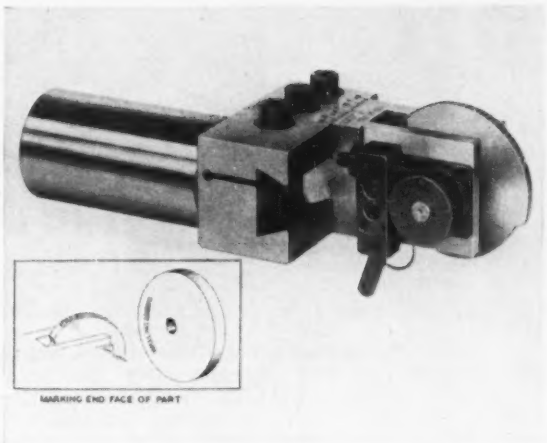
Pines bench type machine for pointing and finishing rod ends



Universal box angles brought out by Challenge Machinery Co.



View of "Truarc Grip Ring" showing method of using this retainer to take up end play of shaft



End-face marking device for screw machines made by New Method Steel Stamps, Inc.

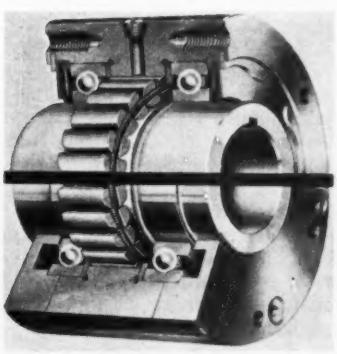
"Truarc Grip Ring" Locking Collar for Small Shafts

A low-cost fastener which provides a positive shoulder on a shaft is a recent addition to the Truarc line of retaining rings made by Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y. Designated "Truarc Grip Ring" Series 5555, this retainer can be readily assembled and disassembled on a straight, ungrooved shaft with Truarc pliers. This grip ring can be used effectively as a means of taking up end-play by simply installing it tightly against the machine part as shown in the illustration. Available for shafts 1/8, 3/16, 1/4, 5/16, and 3/8 inch in diameter.

Formsprag High-Speed Over-Running Clutches

A recent development of the Formsprag Co., Dept. M, 23601 Hoover Road, Van Dyke, Mich., is said to make it possible for sprag type over-running clutches to operate at speeds exceeding 3000 R.P.M. A centrifugal throw-out sprag assembly was developed to eliminate any possible rubbing between the sprags and the inner race. This new feature is now available in the Formsprag all-purpose ball-bearing clutch—a standard model with eight possible variations. The accompanying illustration shows two different types of construction, the view above the heavy line showing oil-retaining rings held in place by expansion rings.

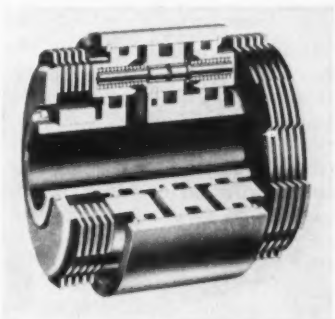
The construction of Formsprag clutches consists of four basic parts: an outer housing, an inner race, a full complement of sprags, and energizing springs. The sprag principle, with its full complement feature, provides an infinite number of gripping positions and eliminates backlash. Maximum torque capacity (for size and weight) and long life because of changing contact points are other advantages claimed for the sprag type of clutch construction.



View of over-running clutch which shows two types of construction

Roll Marker Developed to Mark the End Face of Screw Machine Parts

A Model 600-E marking device for screw machines, designed to mark part and patent numbers and trademarks, on the end face of work-pieces during the machine cycle, has been added to the line of automatic roll markers manufactured by New Method Steel Stamps, Inc., 147 Jos. Campau, Detroit 7, Mich. This marker is suitable for both light and heavy work on automatic and hand-operated screw machines, bench and turret lathes, etc. It will mark parts of any face diameter 1 1/2 inches and up. Either solid or interchangeable type dies can be used in the roll-holders.

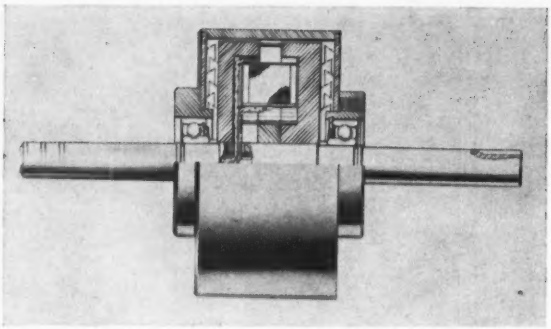


Oil-actuated multiple-plate clutch announced by the Twin Disc Clutch Co.

Oil-Actuated Multiple-Plate Clutch

The Twin Disc Clutch Co., Dept. M, Racine, Wis., has announced an oil-actuated multiple-plate clutch designed for general industrial use. This compact clutch is available in two models—MOS (single) and MOD (duplex).

An outstanding advantage of this oil-actuated clutch is that no adjustment is required to compensate for friction plate wear, since the floating or pressure plate serves as the ram of the cylinder. As the plate stack wears, the ram travel increases automatically. Thus, the torque capacity of the



Partial cross-sectional view of Clark magnetic-particle clutch

clutch for any given oil pressure is always the same. The clutch has a no adjustment feature, an advantage in that, with constant torque capacity assured, it is often possible to use a smaller clutch. The oil-actuated design permits the torque capacity to be directly proportional to the applied oil pressure, since this pressure creates the clamping force.

Hammond Extended-Spindle Polishing and Buffing Lathe

Hammond Machinery Builders, Inc., Dept. M, 1600 Douglas Ave., Kalamazoo, Mich., has announced the Model 10 VROW 10-H.P. wide-swing variable-speed polishing and buffing lathe. This lathe is furnished with an extended spindle designed to give maximum working area around the wheels. It has a variable-spindle speed range of 1500 to 3000 R.P.M. A dial control permits instant changing of speeds while machine is running.

Clark Magnetic-Particle Clutch

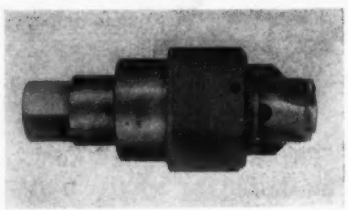
The Clark Mfg. Co., Dept. M, 1830 E. 38th St., Cleveland 14, Ohio, has announced the development of a "Dynamatic" magnetic-particle clutch. This driving unit is an innovation in magnetic clutches in that iron particles are replaced by more stable particles of stainless steel. Lack of wearing parts, fast response, full range of torque transference from zero to full capacity, and smooth operation are advantages claimed for the clutch. It also operates as a combination clutch and brake in either direction.

This clutch consists essentially of two independent rotating members—a driving element and a driven element. The two members are separated by a space which is filled with small ferromagnetic particles (stainless steel). When one of these members is energized —usually with an electromagnet coil—the particles polarize and bind together. This, in turn, binds the two rotating members together with a force that is in direct proportion to the energy induced.

Polishing and buffing machine made by Hammond Machinery Builders, Inc.

Landis Tap Designed to Thread and Chamfer Pipe in One Operation

The Landis Machine Co., Dept. M, Waynesboro, Pa., is placing on the market special solid adjustable taps for tapping and chamfering standard pipe and drainage



Tap designed to thread and chamfer pipe in one operation made by Landis Machine Co.

fittings in one operation. These taps are now available in seven sizes, for pipe ranging in size from 1 1/4 to 4 inches. They are designed for application in reversing spindle type machines.

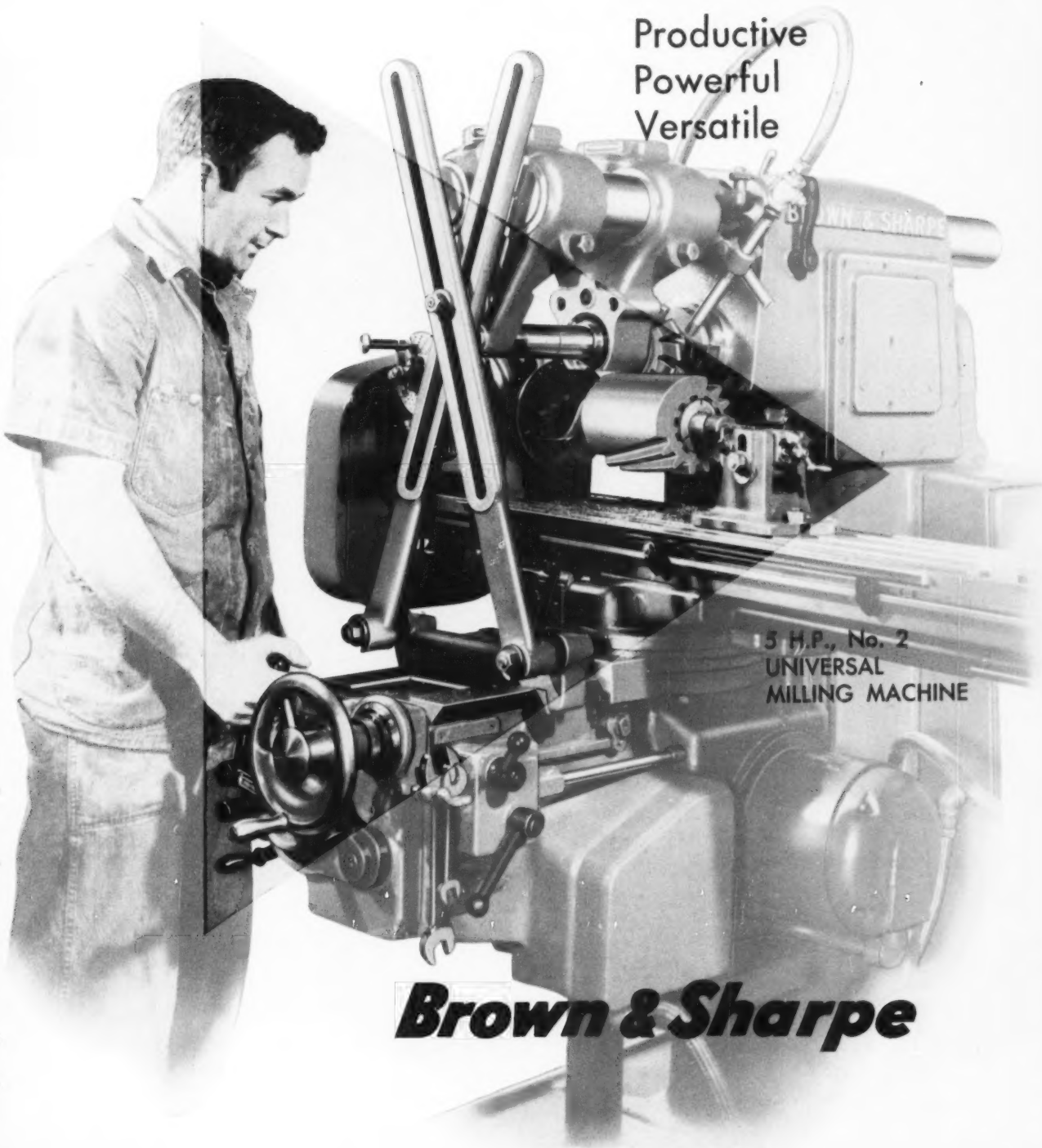
The outstanding feature of this tap is the incorporation of chamfering blades in the tap body. These blades save handling time due to the elimination of a separate chamfering operation. The use of removable tap chasers and chamfering blades, which can be easily and economically replaced after repeated regrinding, also lowers tool costs and inventories.

The tapping operation is performed on the forward portion of the machine cycle while the chamfering is completed on the reversing segment of the cycle. This feature provides two advantages: it divides the torque load, for smoother cutting with less strain; and supplies a chamfer without "leave-off" marks. The taps will be furnished with square or hexagon end drivers or cylindrical shanks. Models are available for either right- or left-hand and straight or tapered tapping. They are of compact design and sturdily constructed for service on high-production machines.

(New Shop Equipment Section continued on page 241)

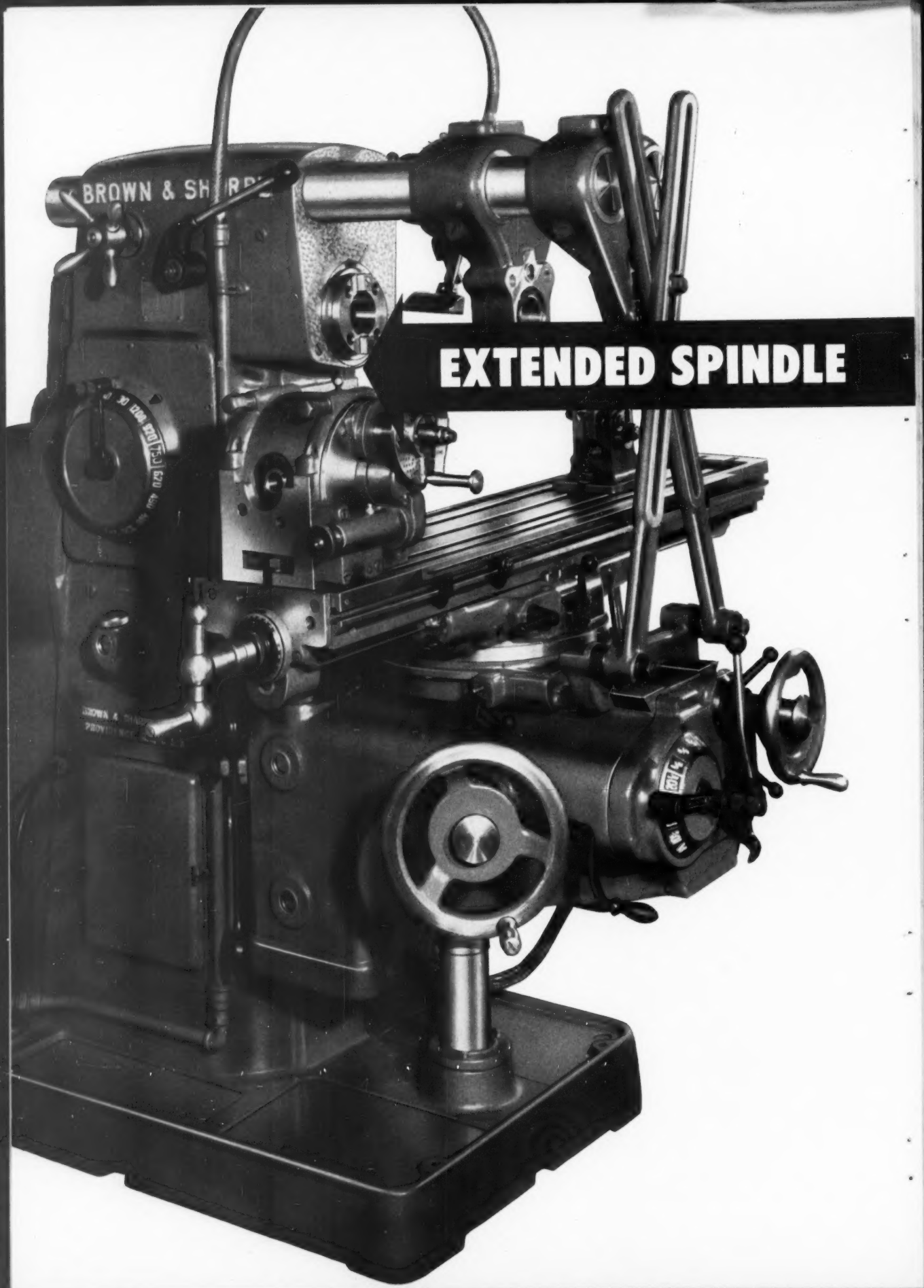
UNIQUELY BALANCED...

Productive
Powerful
Versatile



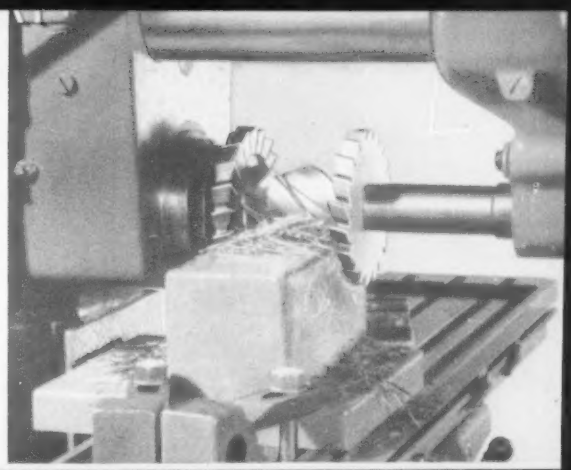
5 H.P., No. 2
UNIVERSAL
MILLING MACHINE

Brown & Sharpe


EXTENDED SPINDLE

. . . gives more rigid cutter support

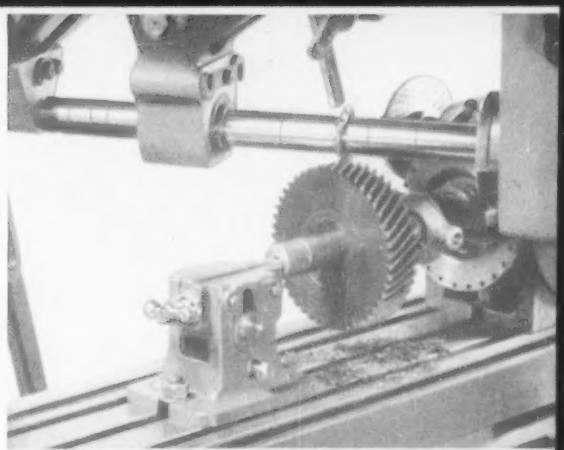
The 5 H.P. Brown & Sharpe No. 2 Universal Milling Machine is shown here set-up for a multiple milling cut. This is an excellent example of the exclusive Extended Spindle Face which permits using cutters close to spindle nose, affording the greatest possible rigidity. Heavy cuts at fast feeds are thus possible . . . often with smaller, less expensive arbors and cutters.



FACE permits heavier cuts...

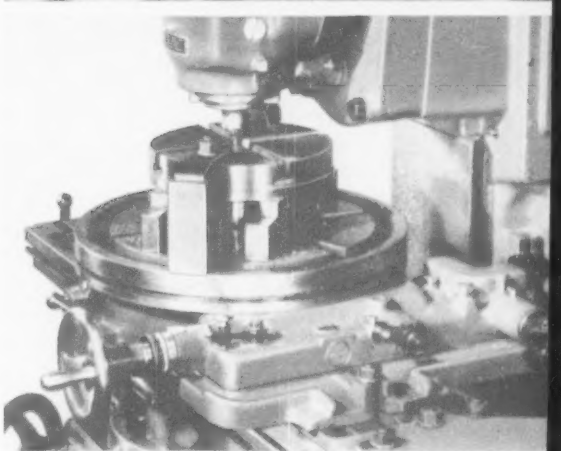
. . . reduces arbor deflection

This milling operation shows how Extended Spindle Face permits cutting closer to spindle nose with considerable swing of table . . . minimizing arbor deflection even on heavy cuts.



. . . provides added clearance for work and fixtures

The 5 H.P. Universal is shown here with Vertical Milling and Rotary Attachments. Note that the Extended Spindle Face provides ample clearance for large or irregular work pieces or holding fixtures . . . gives maximum rigidity of attachments without loss of throat distance.



No. 2 Universal Milling Machine, 5 H.P.

In addition to the many advantages of its exclusive Extended Spindle Face, this 5 H.P. machine gives you a host of other important features that contribute to its greater productivity, power, and versatility. It's a machine you can't afford to overlook when "shopping" for this type equipment. Look over the additional design features of the 5 H.P. Universal on the following page.

Brown & Sharpe

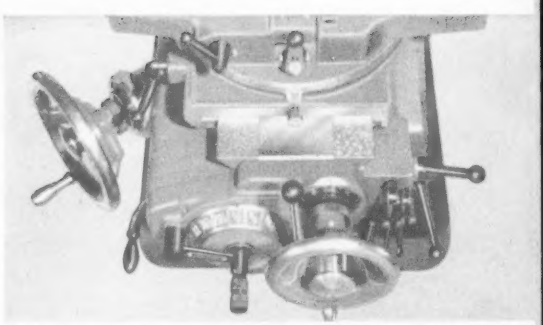
Tri-Motor Drive for efficiency . . . no clutch needed

3 individual driving motors . . . full 5 H.P. for spindle, ¾ H.P. for table, and ¼ H.P. for coolant . . . advantageously placed. Saves power loss within machine, assuring full power for driving cutter. Feed motor coordinated with spindle motor. Thus entire machine is controlled by start-stop lever. All-gear drive.

BONUS-FEATURES of the 5 Horsepower No. 2 Universal

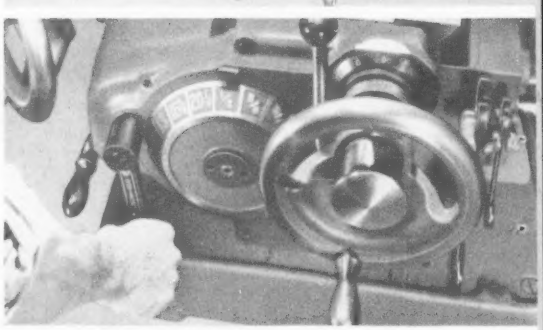
Time-saving Controls Speed Production

Convenient fan-like arrangement of all operating controls promotes easy operation. Other control features include: directional feed control levers; longitudinal feed lever that cannot be engaged when table is clamped; fast travel in all directions with spindle rotating or stopped.



18 Feeds — 18 Speeds — quickly selected . . .

Wide choice of feed rates in range where majority of work is milled . . . 14 of the 18 under 10" per minute. Ease of selection prompts operator to change to most productive rate as conditions warrant. 18 changes of speed give suitable cutting speeds from small end mills to large face mills . . . on a wide variety of materials.



- Well-proportioned for rigidity under capacity loads.
- Uniform feed and fast travel in all directions . . . gives same surface finish for longitudinal, transverse or vertical cuts, without changing feed rate.
- Automatic lubrication provided on all driving mechanisms.

Write for illustrated literature on the 5 Horsepower Universal, or any of the other Brown & Sharpe Products listed below.

Brown & Sharpe B·S

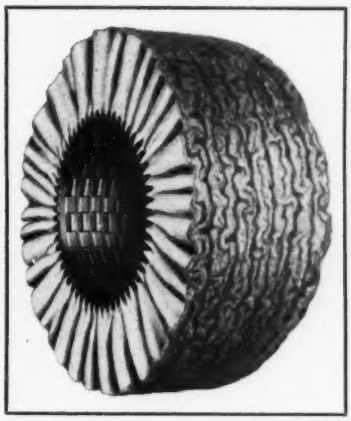
Milling Machines • Grinding Machines • Screw Machines • Cutters
Machine Tool Accessories • Machinists' Tools • Johansson Gage Blocks
Electronic Measuring Equipment • Permanent Magnet Chucks • Pumps

BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U. S. A.

PRINTED IN U.S.A.

Improved Automatic Centerless Buff

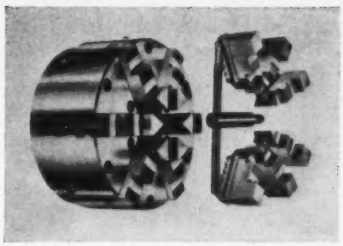
Automatic centerless buff quickly assembled by means of a rigid steel ring arrangement that securely grips the buff cloth in a clamping channel. This buff is designed to retain its strength and shape under the most severe running conditions and to give cool-



running and long-wearing service. Product of the American Buff Co., 2414 S. LaSalle St., Chicago 16, Ill.

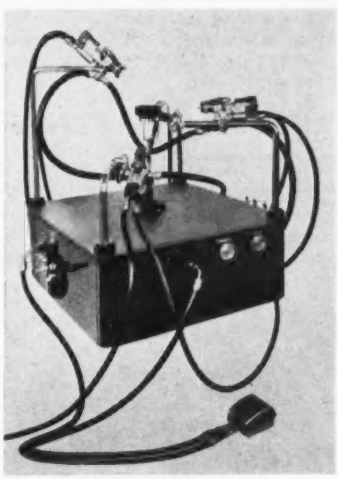
Adjustable Adapter for Die Feeds

Adjustable feed mounting adapter announced by the H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass. The adapter is designed for use with the several models of die feeds and the "Rol-Di-Feed" manufactured by the company. It permits quick, easy adjustment of the stock line of the feed with that of the die, and also the alignment of the feed with the set edge of the die. Vertical adjustment is attained through use of the built-in screw jack. Slotted screw holes in the mounting base permit horizontal adjustment.



Scroll Chuck for Duplicate Work

"Ajust-Tru" 9-inch chuck recently added to the line of smaller chucks manufactured by the Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich. The scroll chuck embodies all the features of the smaller chucks and guarantees a high degree of precision. It permits rapid rechucking on duplicate work up to 8 inches in diameter. Generated teeth on the pinion and bevel gear portion of the scroll provide smooth operation. The chuck is available with three or six internal and external jaws.

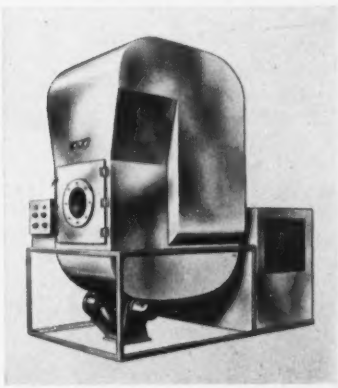


Automatic Painting Machine

Automatic, single-spindle painting machine designed for short runs can be used in most standard spray exhaust booths. One dial regulates the spindle speed from 100 to 400 R.P.M., while a second dial controls the length of time the spray guns operate. The spindle and guns go into action at the touch of a foot pedal, but stop automatically as predetermined by the dial settings. Provision is made for mounting up to four guns, one in each corner, as required to cover the work. The work-holder serves also as a mask. Produced by the Conforming Matrix Corporation, 342 Factories Bldg., Toledo 2, Ohio.

Unit for Sand and Dust Environmental Testing

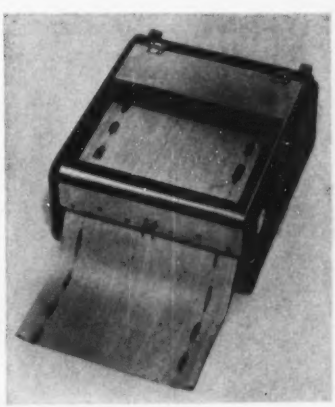
Self-contained unit for sand and dust environmental testing, announced by American Research Corporation, Bristol, Conn. A feature of this equipment is the automatic temperature and dust density control which permits tests to be set up for long-term runs without



constant manual regulation. Air velocity is maintained constantly throughout the run at the pre-set speed. Humidity indication is also provided for preconditioning the equipment. The unit is available in several sizes to meet various testing requirements.

Portable Six-Channel Oscillograph

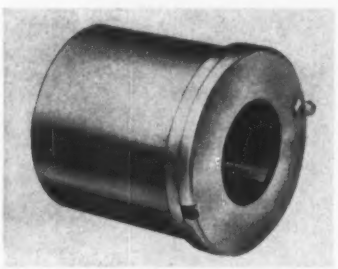
Six-channel oscillograph made by the Brush Electronics Co., Equipment Division (42H), 3405 Perkins Ave., Cleveland 14, Ohio, for use where a lightweight, compact, and portable instrument is needed. This model permits the simultaneous recording of six channels of instantaneous electrical or mechanical phenomena which can be converted to electrical phenomena in the frequency range of direct current



or 0 to 100 cycles per second. A window in top of instrument permits viewing chart as information is recorded. Controls provide starting, stopping, and selection of chart speeds of 5, 25, and 125 millimeters per second. Cable and junction box provide outlets for connecting six Brush amplifiers to the oscillograph.

Needle Bearing Pilot Bushing

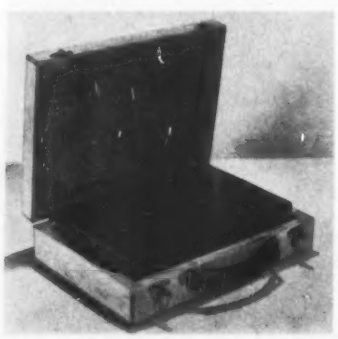
Needle bearing pilot bushing with new seal announced by J. G. Jergens Co., 11106 Avon Ave., Cleveland, Ohio. This needle bearing bushing is



said to have a seal which positively prevents dirt, coolants, and grit from entering the bearing cavity. The design of these bushings is also said to permit closer center distance mounting. They can be disassembled without removing the housing, provide protection against thrust as well as radial loads, and can have keys or keyways.

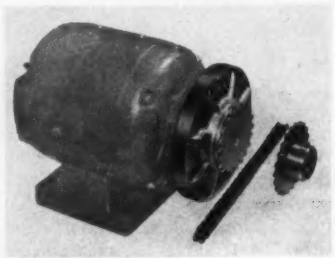
"Ultra-Flat" Portable Surface Plate

Velsey granite "Ultra-Flat" portable surface plate 8 by 12 by 2 1/2 inches and of four-lip design. The over-all surface accuracy is within 0.000025 inch. The hardwood case is ruggedly built and can be furnished with a lock. Plate and case together weigh approximately 20 pounds. Made by Elkro Co., 738 Albany St., Dayton 8, Ohio.



Fluid Drive Coupling for Small Motors

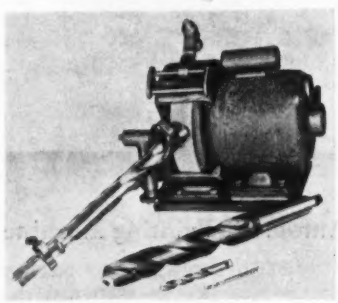
Motor equipped with new fluid drive manufactured by L & S Industries, Box 577, Norwalk, Calif. This drive utilizes silicone fluids and is operated



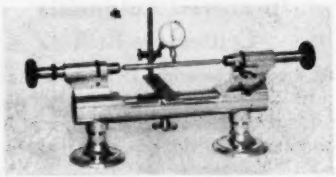
by an entirely new principle. It is no larger in diameter than the standard motor and adds only 1/4 inch to the over-all length of the motor. The unit is furnished complete with flexible coupling for attaching to driven shaft, or with a V-belt pulley. The smooth acceleration of inertia loads made possible by this drive serves to prevent overloading of the motor or the driven equipment. Available in sizes from 1/4 to 4 H.P. at 1800 R.P.M.

Alden Twist Drill Grinder

Twist drill grinder designed to combine simplicity of operation with the high degree of accuracy required to increase the life and efficiency of two-flute twist drills. This Model 200 grinder

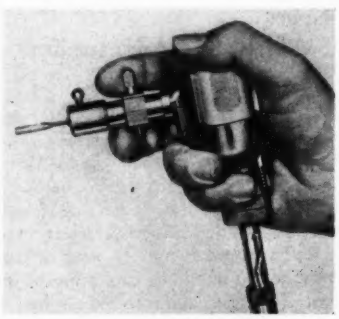


requires only two holders to sharpen all sizes of straight- or taper-shank twist drills from 1/8 inch to 1 1/2 inches. Thus, change-over time is held to a minimum when several different sizes are sharpened. An infinite range of point angles for drilling different kinds of materials is instantly obtainable. Calibrated for the standard 59-degree point, as well as other frequently used drills having point angles of 90, 130, and 140 degrees. Product of Alden Industries, 132 Sackett St., Cuyahoga Falls, Ohio.



Portable Bench Centers

Precision-made portable bench centers developed by the Fearless Tool Co., 7045 Darby Ave., Reseda, Calif., for rapid inspection of small parts. These small, lightweight centers provide a simple and accurate means for holding parts to be inspected. A precision dial indicator is employed, as illustrated, to show run-out. Work mounted on arbors can be rapidly checked. Available in two models, one with a 12-inch bed having a maximum center distance of 8 inches and the other with an 18-inch bed and maximum center distance of 14 inches. Both models will take work up to 3 1/4 inches in diameter, and can be made with collet type center-holders so that internal and external centers and special fixtures can be used.



Reciprocating Stroke "Di-Profiler"

"Di-Profiler" incorporating new developments in precision reciprocating hand machines, announced by the Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. The stroke is variable from 0 to 1/4 inch and the reciprocating speed can be adjusted to any number of strokes up to 100 per second. The tool can be used for accurate high-speed filing, lapping, scraping, honing, and polishing operations on delicate and intricate work. It can be used for honing and lapping straight and curved surfaces; re-working hardened materials; finishing complicated dies and molds; and precision lapping small holes. A wide range of diamond and tungsten-carbide files, points, blades, scrapers, cutters, etc., are available for use in this tool.

One set-up saves 30%

Photos courtesy of the Kelman Electric & Mfg. Company, Los Angeles, California.

Boring, facing, and high speed drilling with one set-up cut the floor to floor time about one-third on this job.

The Kelman Electric & Mfg. Company say their Cincinnati Super Service Radial Drill "handles easily, is very accurate and versatile."

They are facing 6" diameters; drilling for ½" bottom tap, and tapping with a ½" bottom tap on this job.

The part being processed is a Bronze Top Casting.

Cincinnati Super Service Radial Drills are profit makers in this shop, and they could be in yours.

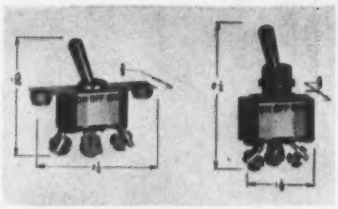
Write for Bulletin R-21C

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

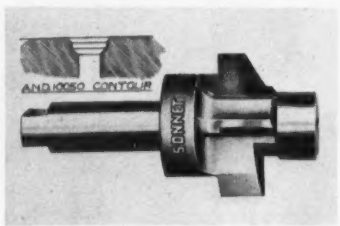


Micro Toggle Switches

Toggle switches of new series that conform to AN (Army-Navy Aeronautical) and JAN (joint Army-Navy) specifications, announced by the Micro Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill. These switches have riveted solid silver contacts to prevent loosening and provide maximum conductivity and heat dissipation. One of the series, IITS, consists of nine single-pole toggle switches with either maintained or momentary contact position variations. AN and JAN ratings for this series are as follows: on the maintained contact versions, 20 amperes resistive load at 30 volts direct current; 15 amperes resistive load at 125 volts alternating current; and on the momentary contact version, 15 amperes resistive load at 30 volts direct current, and 125 volts alternating current.

Special Cutter Designed to Produce Port of Correct Contour in One Operation

Carbide-tipped tool obtainable from Sonnet Supply Co., 576 N. Prairie Ave., Hawthorne, Calif. This tool is designed to produce the Army and Navy port or connecting holes for hydraulic valves, fittings, etc. It has four flutes, and each flute performs an operation,



thereby producing the form shown in the cross-sectional view in the illustration. During the cutting cycle, the tool is piloted in the minor thread diameter to insure concentricity. The tool is carbide-tipped to give long life and good finish in both ferrous and non-ferrous material. Both the pilot and shank are hardened and ground.

Improved Dial Indicator

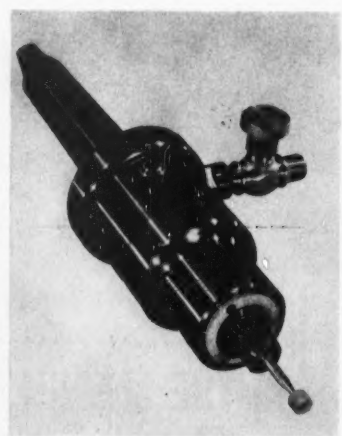
Vipp dial indicator of improved design for use with any height gage, being introduced in this country by Homestrand, Inc., Larchmont, N. Y. This precision instrument of Swedish manufacture is versatile, compact, and adjustable to all possible positions. It is especially useful in making comparisons with gage-blocks, etc. The indicator can be easily attached to stands and machines for indicating work being set up, as well as completed machine parts. It can be furnished with a slitted ball to facilitate setting in a chuck. A lever on the side of the body reverses direction of movement of contact point, which is equipped with a joint, permitting it to be set anywhere within a range of plus and minus 90 degrees. The dial has 0.001 inch graduations in a range of plus or minus 0.015 inch.

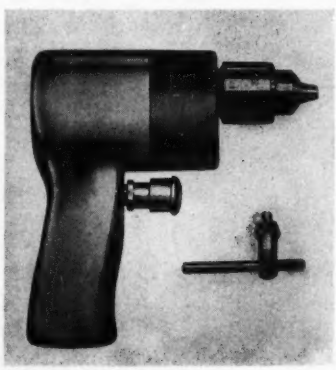
Diamond Lapping Compounds and Equipment

Master kit of diamond lapping compounds and equipment consisting of nine "spectrum" grits, sizes 120, 170, 325, 600, 1200, 2000, 3000, 8000, and 14,500, and three other grit sizes in accordance with U. S. Bureau of Standards specifications. Available from the Penn Scientific Products Co., 5941 Alma St., Philadelphia 241, Pa. The kit also includes a 4-ounce bottle of diamond lapping oil, an atomizer oil applicator, an assortment of Spectrum micro laps, orangewood sticks, and an assortment of felt mounted points.

Vulcanaire High-Speed Spindle Equipped with Air Muffler

High-speed air-operated spindles manufactured by the Vulcan Tool Co., 730 Lorain Ave., Dayton 10, Ohio, are now being equipped with mufflers which are spid to eliminate approximately 60 per cent of the noise caused by the discharge of air from the exhaust port. By dissipating the exhaust energy through hundreds of small openings the resulting flow enters the outside atmosphere in a much smoother manner.





Portable Pneumatic Drill

High-torque portable pneumatic drill of 1/4-inch capacity brought out by the Brown Tool Mfg. Co., 9422 Trenton Ave., St. Louis 14, Mo. This drill has a speed of 2600 R.P.M. Its eight-vane motor is said to produce a very high torque on very low air pressures. Satisfactory operation is obtained at pressures as low as 28 pounds per square inch and it is practically impossible to stall the motor during operation at the normal pressure of 90 pounds per square inch. Motor and gear box are manufactured as one complete sealed unit, with replacement assemblies furnished at comparatively low costs.

HANDLE ALL YOUR EMULSIFYING CUTTING OIL NEEDS with S.E.C.O. and S.E.C.O. HD "F"

Sunoco Emulsifying Cutting Oil — For general-purpose cutting and grinding. This product is more widely used in metal-working plants than any similar oil. It has high emulsion stability and cooling efficiency, excellent lubricating and rustproofing characteristics. Those features, plus low initial cost, make S.E.C.O. ideal for a wide range of machining, grinding and rolling operations on both ferrous and nonferrous metals.

Sunoco Emulsifying Cutting Oil HD "F" — For heavy duty cutting. Its extreme pressure properties give it a film strength more than twice that of regular emulsifying oils. This high film strength, plus increased "oiliness" characteristics, makes it ideal for machining jobs too tough for regular soluble oils and too hot for straight cutting oils. Emulsions of S.E.C.O. HD "F" are clean smelling and will remain so in service.

For complete data on S.E.C.O. and S.E.C.O. HD "F," call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. M-6.

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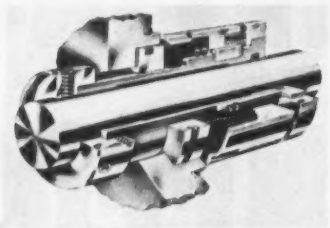
Heavy-Duty Balanced Mechanical Seal

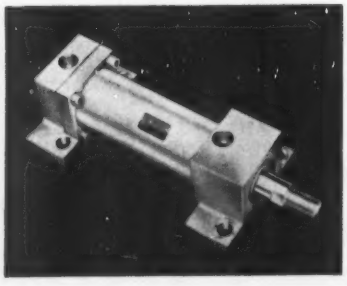
Heavy-duty mechanical seal, which will withstand pressures up to 1000 pounds per square inch, placed on the market by the Crane Packing Co., Department M-4, 1800 W. Cuyler Ave., Chicago 13, Ill. This shaft seal, known as Type 8-B, can be installed or removed from split-case pumps without

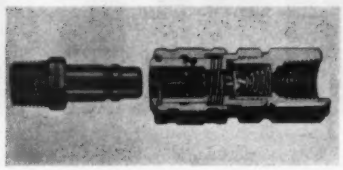


lifting the upper half of the casing. A rotating sealing washer and "floating" stationary seat are incorporated in the design. Balance is obtained by lowering the washer face to a point where the stuffing box pressure is no longer exerted against the sealing area. The rotating assembly consists of a retainer positively driven by the sleeve and a washer driven from "dents" in the retainer. O-rings provide the sealing between sleeve and shaft and also between the washer and sleeve. This construction affords sufficient flexibility in the rotating assembly to compensate for axial and radial shaft movement and for normal wear of the sealing faces.

High-Pressure Hydraulic Cylinders

One of eleven models of space-saving hydraulic cylinders designed for working pressures up to 2000 pounds per square inch. The bore sizes available range from 1 1/2 to 8 inches. These cylinders have a bronze quick-change packing cartridge that can be taken out instantly by removing a snap-ring to permit servicing the packing. Product of S-P Mfg. Co., 12415 Euclid Ave., Cleveland 6, Ohio.





Quick-Detachable Coupler for Pneumatic and Hydraulic Tools

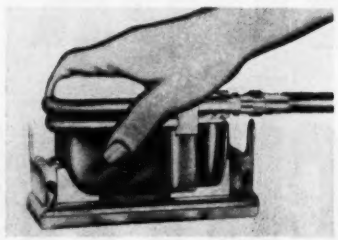
Coupling of the quick-detachable type, manufactured in a series of three size ranges by the Foster Mfg. Co., Inc., 2850 Gravois, St. Louis 18, Mo., to meet the industrial application requirements of pneumatic and hydraulic tools. These groupings include the complete range of capacities from 30 cubic feet of air per minute at a pressure of 100 pounds per square inch, and fluid at 6 gallons per minute at a pressure of 100 pounds per square inch, up to 116 cubic feet of air per minute and 17 gallons of fluid per minute at the regular normal operating pressures of 100 pounds per square inch.

Flexible Electrical Conduit with Synthetic Covering

"Sealtite" flexible electrical conduit Type UA, said to be the first of its kind to gain Underwriters' Laboratories approval for use in wet locations. This liquid-tight flexible metal conduit is manufactured by the American Brass Co., Dept. M, Waterbury, Conn. The tough, extruded synthetic covering over a flexible metal core protects the wiring against moisture, oil, dirt, chemicals, and corrosive fumes on permanent and temporary installations. Available in long lengths in nominal sizes from 3/8 inch to 1 1/4 inches in diameter.

Lightweight Single-Pad Air Sander

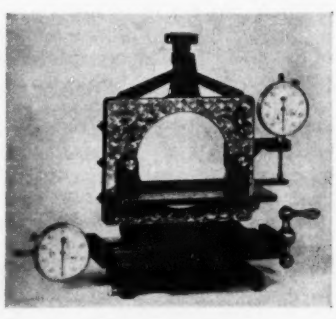
Reciprocating air-powered Model J-R finishing sander with straight-line stroke, but without objectionable vibration, brought out by the Detroit Surfacing Machine Co., 1333 E. Eight Mile Road, Detroit 20, Mich. Features of this sander are light weight (only 4 pounds), small palm-size grip for



maximum operator comfort, air switch-type control, no-surge automatic mist type water spray for wet sanding, and easy to use abrasive holder for attaching several sheets of sandpaper at one loading. Cutting at the rate of 4500 strokes per minute is obtained with an air operating pressure of only 50 to 60 pounds per square inch. Provision for up to a 2-inch off-center adjustment of the pad permits sanding in grooves (drip moldings), and other hard-to-reach areas.

Coordinate Measuring Stage for Optical Projectors

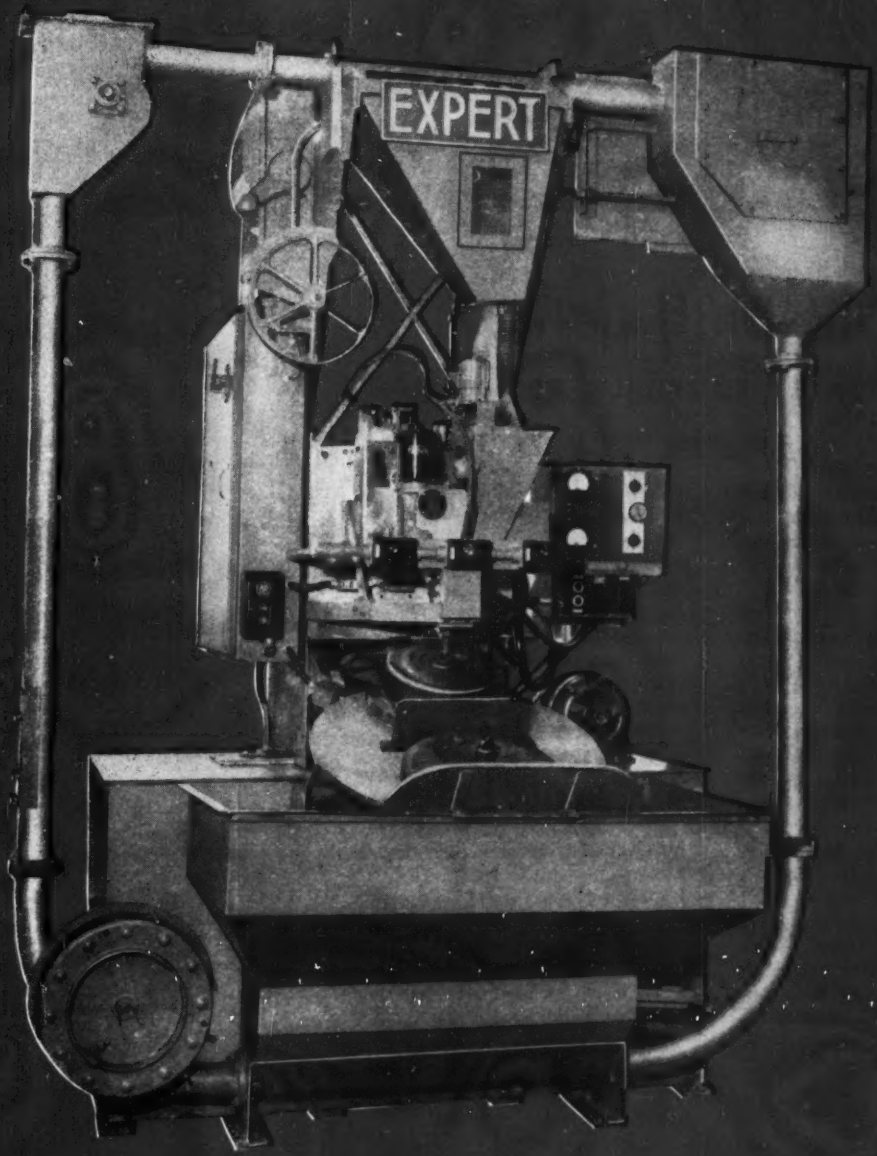
Coordinate measuring stage for use on bench optical projectors, just announced by the Portman Instrument Co., Inc., 6 Manhasset Ave., Port Washington, N. Y. This stage has a longitudinal, vertical, and focussing travel each of 1 inch. With the addition of two 1-inch travel dial indicators, it is possible to make coordinate measurements. The stage is also provided with an adjustable right-angle platform that can be positioned in three different horizontal planes. This accessory can be easily adapted for use on any bench optical projector.



AUTOMATIC SUBMERGED

Arc Welding Machine

for TORQUE CONVERTER



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"A Triple play BY RB&W REALLY SAVED US PLENTY!"

"It took us by surprise," Al went on, "when an RB&W man told us* he could speed up assembly of this precision screw-and-clamp unit and save us money besides. We figured we'd been doing O.K. the old way."

"What was the old way?" asked Mac, who'd recently started in at the shop.

"Well, it was a one-two-three operation. We used to machine the slotted-head screw for the clamp on that machine over there. Then we'd make a special collar, and fit it around the screw head to prevent the screw-driver from slipping out of the slot while the clamp was being applied or adjusted.

"What RB&W did was to cold-form the whole thing—screw, slot and collar—all in one piece. Wasn't an easy job, either—they had to strike a slot in the screw head and form the collar at the same time. Now we're saving one-third on our previous assembly costs—along with the price of the special collar."

Which proves that you can generally cut costs, if you look hard enough . . . even in such simple things as fasteners. It also underlines the creative approach to fastening problems you can expect from RB&W, as well as practical experience in designing and fabricating. If the fastener you need can't be supplied from our extensive stock, we'll study your assembly operation and make the right one for the job.

Remember—for any fastening operation, it's a smart move to call in RB&W. You can count on RB&W bolts, nuts, screws and rivets for uniform accuracy, dependability and physical properties. And you can also count on fast service from RB&W's strategically located plants at: Port Chester, N. Y., Coraopolis, Pa., Rock Falls, Ill., Los Angeles, Calif. Additional sales offices at: Philadelphia, Pittsburgh, Detroit, Chicago, Dallas, San Francisco. Sales agents at: Portland, Seattle. Distributors from coast to coast.

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

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*George K. Garrett Co., Philadelphia, Pa.

RB&W 108 YEARS MAKING STRONG THE THINGS THAT MAKE AMERICA STRONG

PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on New Catalogues described in the June, 1953, issue of MACHINERY. Circle Key number of item in which you are interested and print name and address on postcard.

NEW CATALOGUES

BROACHING PRACTICE—National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich. Manual entitled "Broaching Practice," containing 80 pages of worthwhile information, compiled from the experience of Red Ring broach engineers over the last twenty-five years—as, for example, the chapter on broaching troubles and how to correct them. The manual is available to key personnel of metal-working plants upon request to the above address.

MACHINE TOOLS AND ACCESSORIES—Morey Machinery, Inc., 410 Broome St., New York 13, N. Y. Catalogue consisting of 180 pages of concise information on domestic and European machine tools distributed by the company as well as on Morey lathes, profiler type milling machines, vertical shapers, and accessories for turret lathes. The company's engineering and rebuilding services are also described. Can be obtained when requested on a business letterhead direct to the above address.

PRESS BRAKES—Cincinnati Shaper Co., Cincinnati, Ohio. Catalogue B-4, consisting of 72 pages of information on the Cincinnati press brake. Standard features, fundamentals in selecting a press brake, specifications and dimensions of Cincinnati press brakes, and applications of press brakes are considered. A section on punching equipment and dies is included. 1

BLAST CLEANING—The Pangborn Corporation, Hagerstown, Md. Bulletin 100A, featuring blast-cleaning hose machines for hand-operated cleaning jobs. The methods of applying abrasive are described, as well as the applications of both wet and soft abrasives. A table shows how to match the nozzle size to the size of the abrasive being used. 2

POLYETHYLENE PLASTIC—Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York City. Revised booklet entitled "Bakelite Polyethylene," emphasizing with photographs and data the greatly increased use of polyethylene. Two new tables have been added to the seven tables previously included, of interest to fabricators and other users of this plastic. 3

ALLOY SPRING STEELS—International Nickel Co., Inc., New York City. Pamphlet presenting data on the physical properties of chromium-nickel-molybdenum, chromium-vanadium, and silico-manganese alloy steels used for the fabrication of hot-formed springs, together with the properties of a plain carbon steel as a comparison. 4

CAN AND CONTAINER MAKING MACHINERY—E. W. Bliss Co., Canton, Ohio. Catalogue 36-A, illustrating and describing both Bliss automatic and semi-automatic machines, including slitters, body makers, seamers, flangers, beaders, and testers used in manufacturing cans and containers. Specifications for all the machines are given. 5

STEEL KOLDFLO PROCESS—Mullins Mfg. Corporation, Warren, Ohio. Booklet entitled "Mullins Steel Koldflo Product Design Guide," in which seventeen new commercial applications of the Koldflo process are described and illustrated. Sketches show the wide variety of shapes that can be produced with this process. 6

TUBING—Nikoh Tube Co., Chicago, Ill. Catalogue descriptive of the company's facilities for the manufacture of electric weld tubing. Various operations are shown, applications of the tubing in various industries are listed, and data and reference material are presented in the concluding six pages. 7

CHUCKS—Horton Chuck Division of E. Horton & Son Co., Windsor Locks, Conn. Catalogue E-100, containing 50 pages of information designed to simplify the specifying and buying of Horton chucks, including independent, universal, combination, light-duty, and two-jaw chucks, as well as faceplate and boring-mill jaws. 8

RESISTANCE WELDING—General Electric Co., Schenectady, N. Y. Bulletin GEA-5816, explaining what materials are suitable for resistance welding, the essential steps in making a weld, and the principal types, including spot, seam, projection, and butt welds. Six basic assemblies are described. 9

INDUSTRIAL CONTROLS—Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Catalogue 8305, containing 80 pages of information on the company's line of non-indicating electric, electronic, and pneumatic controllers for temperature, pressure, and humidity, as well as pneumatic and electric valves, switches, and relays. 10

GENERAL-PURPOSE RELAYS—General Electric Co., Schenectady, N. Y. Bulletin GEC-257C, featuring a new line of general-purpose relays suitable for application in electronic equipment, air conditioners, and as starters for small alternating-current motors where the motors have sufficient overload protection. 11

STAINLESS-STEEL BARS—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Booklet on Allegheny metal bars, containing information to aid the user in the selection of the proper stainless-steel material for the job at hand. There are reference tables on sizes and shapes available, weights, and corrosion resistance. 12

STANDARD AND SPECIALIZED TOOLS—Cornwell Quality Tools Co., Mogadore, Ohio. Catalogue containing 128 pages of detailed descriptions of Cornwell tools and tool sets. Among the types of tools covered are wrenches, screwdrivers, drills, saws and punches, torque wrenches, spring testers, and reamers. 13

SERVICE MANUAL FOR AIRCRAFT INDUSTRY—E. F. Houghton & Co., Philadelphia, Pa. Manual entitled "Specialized Service to the Aircraft Industry," describing the technical service offered by the company to the aircraft industry, and presenting helpful product application information. 14

STAINLESS-STEEL WIRE—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Booklet of technical data on the application of stainless-steel wire. Tables of physical properties, corrosion resistance, and analysis are included, and principal uses described. 15

HORN TYPE PRESSES—Clearing Machine Corporation, Chicago, Ill. Bulletin 223, illustrating and describing Clearing horn type presses. Specifications for the entire press line, as well as cut-away drawings which show engineering details, are given. 16

ALUMINUM EXTRUSIONS—Revere Copper & Brass, Inc., New York City. Booklet on Revere aluminum extruded products, giving typical examples. A simplified section on tolerances is included, and the company's technical advisory service described. 17

ROTARY FILES—R. G. Haskins Co., Chicago, Ill. Bulletin 57, providing descriptions of the Haskins line of rotary files, high-speed steel ground cutters, and carbide tools. A chart of recommended operating speeds is presented. 18

TEMPERATURE CONTROLLER—Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. Bulletin F-5783, describing the Model 200 self-contained Capacitrols that are used for on-off, proportioning, and anticipating control in the solution of industrial heat control problems. 19

INJECTION MOLD TEMPERATURE CONTROL—Sarco Co., Inc., New York City. Bulletin 7, dealing with the subject of injection mold temperature control, including a chart which

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lists mold difficulties occurring when the mold temperature is too low or too high. 20

INDUCTROL POWER PACKS—General Electric Co., Schenectady, N. Y. Bulletin GEA-5928 on Inductrol power packs, which includes a dry type transformer, voltage regulator, and panel board, for alternating-current lighting and power service up to 112.5 k.v.a. and 600 volts. 21

HYDRAULIC (OIL) CYLINDERS—Vickers, Inc., Detroit, Mich. Bulletin 52-55, consisting of a revised edition of Bulletin 49-55, bringing up to date the specifications and engineering information on Vickers hydraulic cylinders for industrial machinery. 22

COLD-FINISHED CARBON STEEL BARS—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Bulletin consisting of a guide to the selection, use, and relative cost of Ryerson cold-finished carbon steel bars. A table of average mechanical properties and machining speeds is presented. 23

VERTICAL MILLING MACHINE—Marac Machinery Corporation, New York City. Bulletin descriptive of the Fritz Werner vertical milling machine suitable for use as a tool-room miller as well as in a mass production plant. The new design features are explained. 24

GEAR-MOTORS—General Electric Co., Schenectady, N. Y. Bulletin GEA-1437H, consisting of an information guide on standard types of G-E Tri-Clad gear-motors with ratings from 1/6 up to 100 H.P. A table classifying gear-motor applications explains how to select the proper motor. 25

MULTIPLE-PURPOSE MACHINE — Multiversal Machine Co., Wauconda, Ill. Bulletin outlining basic features of the Hack Multiversal machine and giving examples of such operations, as milling, jig-boring, slotting, filing, drilling, grinding, turning, and broaching. 26

MEEHANITE CASTINGS—Meehanite Metal Corporation, New Rochelle, N. Y. Bulletin 38, entitled "Meehanite Castings Build Better Machine Tools," showing the use of specific Meehanite castings in component parts of machine tools of all types. 27

ALTERNATING-CURRENT WELDING EQUIPMENT—Westinghouse Electric Corporation, Pittsburgh, Pa. Booklet B-5622, appraising three basic alternating-current welding machines and their accessories from the standpoints of construction and application. 28

ROTARY TABLES—Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Circular 558-1, descriptive of P & W rotary tables, in hand-operated and motor-driven models, for all jobs requiring precise circular spacing and angular positioning. 29

ABRASIVE-BELT GRINDING—Porter-Cable Machine Co., Syracuse, N. Y. Booklet entitled "Wherever There's Industry," containing forty-six case studies of abrasive-belt methods that effected savings on machining operations in a variety of industries. 30

REAMERS—Lavallee & Ide, Inc., Chicopee, Mass. Catalogue 53, containing detailed information on the wide range of standard L & I reamers. A separate price list, indexed for quick reference, gives net prices of items included in the catalogue. 31

MOTOR PARTS—General Electric Co., Schenectady, N. Y. Booklet GEA-5665, presenting the complete line of Type BA motor parts, including rating charts. The company's engineering consultation service is described and some typical design problems reviewed. 32

VARIABLE-SPEED DRIVES—Reeves Pulley Co., Columbus, Ind. Bulletin V-532, describing the Reeves Flexi-Speed drive for converting any standard constant-speed motor to an infinitely variable-speed drive with speed ratio up to 8 to 1. 33

LOCATING SPOTLIGHT—Sciaky Bros., Inc., Chicago, Ill. Bulletin 309-10, covering the Sciaky locating spotlight, which enables production machine operators to accurately position work in blind operations on all types of equipment. 34

PRECISION BORING MACHINES—Ex-Cell-O Corporation, Detroit, Mich. Bulletin 31205, covering the Ex-Cell-O line of standard precision boring machines. Complete specifications are given and unusual applications shown. 35

ALIGNMENT INDICATOR—Eastern Machine Screw Corporation, New Haven, Conn. Leaflet on the importance of proper alignment when cutting screw threads, and how misalignment can be determined with the H & G alignment indicator. 36

GEAR CHECKER—Michigan Tool Co., Detroit, Mich. Bulletin 48-53, covering the Michigan Sine-Line lead and axial pitch checker for large spur, helical, and herringbone gears up to 48 inches in diameter. 37

FLEXIBLE METAL HOSE PRODUCTS—Universal Metal Hose Co., Chicago, Ill. Technical Data Book U-111, giving specifications of various types of flexible metal hose and applications for each type. 38

PRESSURE REGULATORS—Moore Products Co., Philadelphia, Pa. Bulletin 4003, showing five series of Nullmatic pressure regulators, and including performance curves on these instruments. 39

STAINLESS-STEEL PRODUCTS—G. O. Carlson, Inc., Thorndale, Pa. Bulletin descriptive of the company's complete line of stainless-steel plates, heads, discs, rings, forgings, billets, bars, and sheets. 40

POWER FOR ELECTROLYTIC PROCESS—Westinghouse Electric Corporation, Pittsburgh, Pa. Booklet B-5466, evaluating the available methods of obtaining direct-current power for electrolytic processes. 41

METAL-FINISHING—Pelron Corporation, Lyons, Ill. Bulletin describing the company's chemical compounds for metal-finishing operations, as well as the services available for solving special problems of manufacturers. 42

HOLE PUNCHING UNITS—Wales-Strippit Corporation, North Tonawanda, N. Y. Catalogue C, which is descriptive of Wales units for punching holes in angles, extrusions, shapes, and sheets. 43

ELECTRICAL WIRING CONDUIT—American Brass Co., American Metal Hose Branch, Waterbury, Conn. Bulletin UA-530, on Sealtite flexible liquid-tight electrical wiring conduit. Applications are suggested. 44

EXTRUSION TOOLS—Industrial City Boring Co., Van Dyke, Mich. Catalogue acquainting the metal-working industries with the facilities of the company in designing and building tools for extruding steel. 45

ELECTRONIC EQUIPMENT—Scientific Electric, Garfield, N. J. Folder descriptive of high-frequency and high-voltage equipment produced by the company, such as test units, induction heaters, and spot welders. 46

ASME PUBLICATIONS—American Society of Mechanical Engineers, New York City. 1953 catalogue descriptive of ASME publications—books, periodicals, standards, and safety and test codes. 47

CAST BARS AND SHAPES—Hamilton Foundry & Machine Co., Hamilton, Ohio. Folder listing a cast bar stock in Meehanite, gray iron, alloyed iron, Ni-resist, and Ni-hard. 48

BAR BENDING MACHINES—Wm. K. Stamets Co., Pittsburgh, Pa. Bulletin 100-F, describing Stamets machines for automatic bending of metal bar stock 3/8 to 1 inch in diameter. 49

TOOLS—Erie Tool Works, Erie, Pa. Catalogue 353, covering the company's complete line of tools—heavy-duty wrenches, Stillson wrenches, vises, pipe threaders, and pipe cutters. 50

METAL-CUTTING GUIDES FOR HAND TORCHES—New Era Engineering Co., Chicago, Ill. Bulletin 101, descriptive of Neeco flame-cutting guides designed to fit all makes of torches. 51

PRESSURE GAGE—W. C. Dillon & Co., Inc., Van Nuys, Calif. Bulletin PG-2 on the Dillon mechanical pressure gage, showing some applications of the instrument in the shop. 52

DIAL BORE GAGES—Boice Mfg. Co., Staatsburg, N. Y. Bulletin 53, descriptive of Boice dial bore gages and dial indicator gages for inspection operations. 53

NICKEL PLATING—International Nickel Co., Inc., New York City. Reprint entitled "High Corrosion Resistance Gives Nickel-Plated Metal Wide Range of Uses." 54

ENVIRONMENTAL TEST EQUIPMENT—American Research Corporation, Bristol, Conn. Folder illustrating basic environmental test chambers manufactured by the concern. 55

AUTOMATIC ROLL MARKER—New Method Steel Stamps, Inc., Detroit, Mich. Bulletin describing an automatic roll marker for end-face markings on screw machines. 56

PUNCH PRESSES—Diamond Machine Tool Co., Pico, Calif. Catalogue on the Multi-Max line of punch presses, explaining construction features. 57

CUTTING TOOL—Nord International Corporation, Denville, N. J. Leaflet descriptive of the Nibblex sheet-metal cutting nibbler. 58

SLIDE FEED—Cooper Weymouth, Inc. Folder descriptive of an improved slide feed for automatic punch press operation. 59

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M-6/53

PLEASE PRINT

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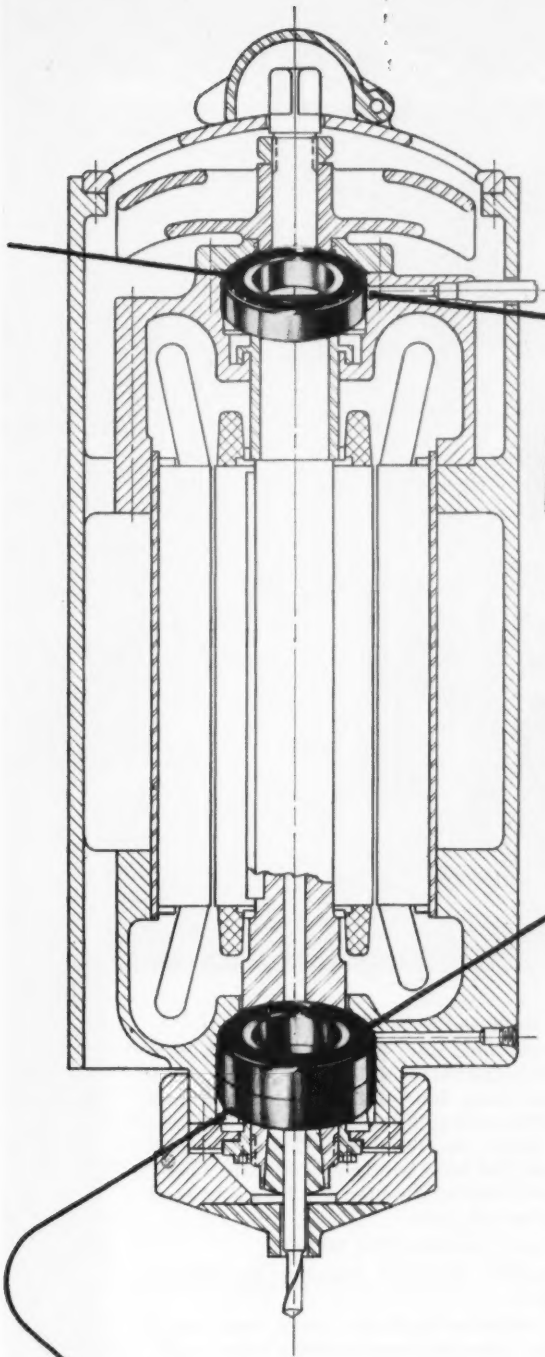
Title _____

Firm _____

Street _____

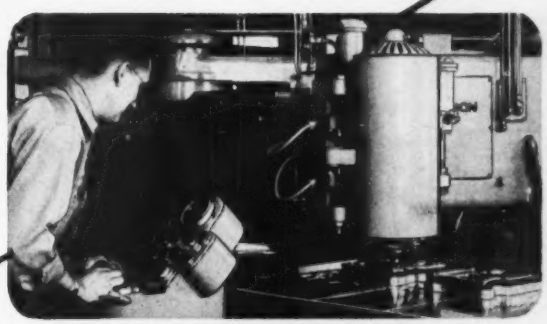
City _____ Zone _____ State _____

This card is void after September 1, 1953



LOOKS SIMPLE

WAIT TILL YOU HEAR WHAT IT DOES!



High-speed, remote controlled router made by Ekstrom, Carlson & Company, Rockford, Illinois.

You guessed it. This is a blueprint of a spindle head. It shows the arrangement of Fafnir Super-Precision Ball Bearings . . . a single bearing at the top duplexed bearings at the work end.
What's unusual about it? Listen to this . . .

The spindle head is part of an Ekstrom, Carlson high-speed, remote-controlled machine that template routes through 1-inch aluminum plate with a single pass and at cutting speeds as high as 90 inches per minute. It is driven by a 30 h.p. variable speed motor and operates up to 15,000 r.p.m. The radial load on the bearings is as high as 500 to 600 pounds. The spindle head takes tool bits with diameters from 5/16" to 3/4".

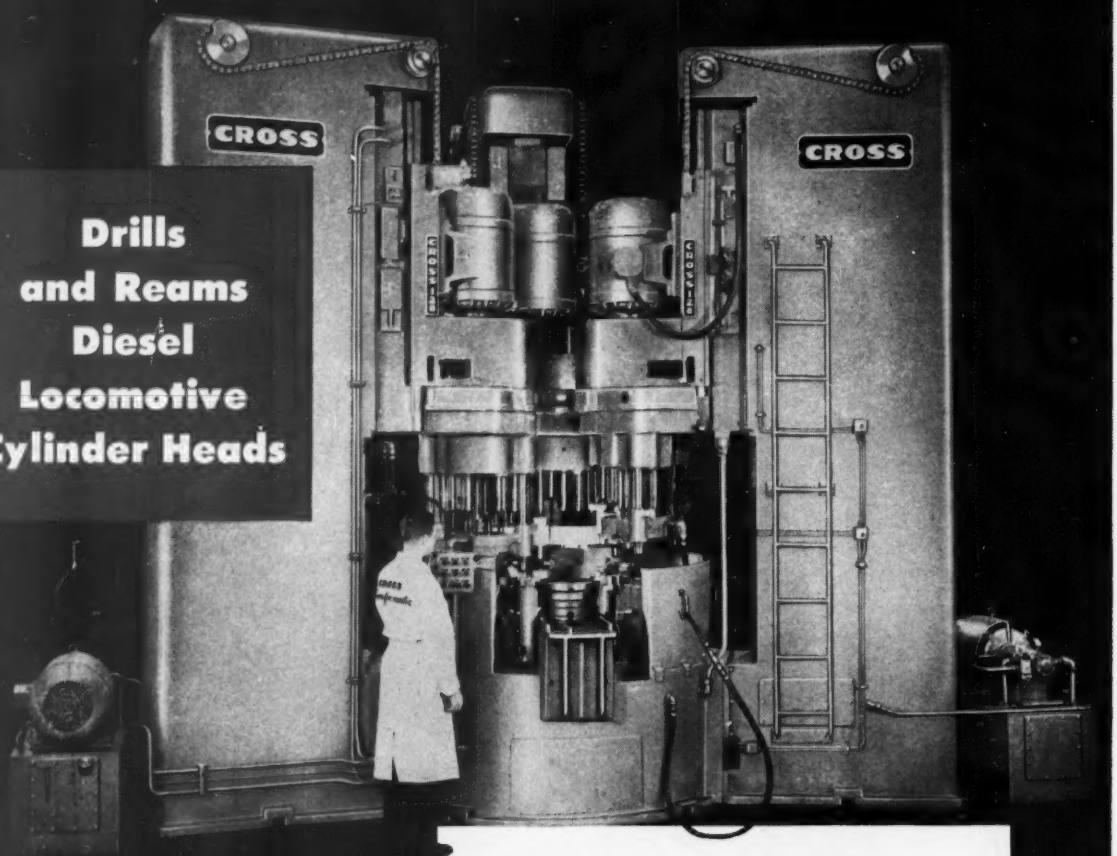
Although the top design achievement of this new machine tool is its electrically-controlled hydraulic feed mechanism, the spindle bearing application is no ordinary accomplishment. Fafnir engineers worked hand-in-hand with Ekstrom, Carlson engineers to make it successful. Another example of the Fafnir "attitude and aptitude" . . . a way of looking at bearing problems from the designers' viewpoint, an aptitude for supplying the right bearing to fit the need. The Fafnir Bearing Co., New Britain, Conn.

FAFNIR

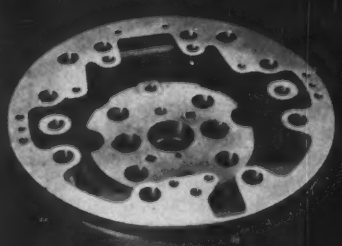
BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

Another Special by Cross



Drills and Reams Diesel Locomotive Cylinder Heads



★ 50 per hour at 100% efficiency.
★ Seven stations: one, load and unload; two, drill 13 holes; three, drill 11 holes and spotface one hole; four, drill 12 holes; five, drill two holes, core drill three holes and chamfer three holes; six, ream nine holes, chamfer six holes and form two spherical seats; seven, ream nine holes, chamfer one hole and form two spherical seats.
★ Fluid motor driven index table.
★ Construction to Joint Industry Conference standards.
★ Other features—Hydraulic feed and rapid traverse, hardened and ground ways, automatic lubrication.

Established 1898

THE CROSS CO.
DETROIT 7, MICHIGAN
Special MACHINE TOOLS

Between Grinds

By E. S. Salichs

Shooting Time

The James Arthur Collection, consisting of specimens of fine watch- and clock-making, has acquired an old pistol-shooting alarm clock that lights a candle when the alarm goes off. The question of a one-year guarantee probably never arose; it was just luck if the clock's owner did.

A Fact or a Figure

Whether to place an information booth at the right or left of the entrance to the Pan Pacific Auditorium for the L.A. Home Show became a matter of debate at a committee meeting. Which way do people have a tendency to turn? A local cafeteria served for research; it was duly noted by a committee scout that the counter on the left had a much longer line than on the right. The manager of the cafeteria was asked for an explanation. "Very simple," he replied. "See that blonde cashier over there? It all depends on where she's stationed."

A Spade is a Spade

Wrong words for machines and parts cost American industry millions of dollars a year, according to the Conveyor Manufacturers Association which has just standardized 1500 conveyor terms and definitions. A bit of advice is being offered as well—"What our Association has done every industry should do."

The Sign is Fine

In greeting, a Chinese crosses his arms to signify good luck. Trademark of the Nicholson File Co. is two files crossed, bearing a similarity to crossed arms. So, when a Chinese in search of a file enters his native hardware shop, he crosses his arms as is his custom, and utters the Chinese equivalent of file. A Nicholson comes from behind the Chinese equivalent of a counter.

You Can Be Sure

No guessing the message sent by the Westinghouse Electric Corporation upon recently opening a new intra-company teletype relay system, one of the largest in the country. From the Boston to the San Francisco office, the message sent was the slogan: "You can be SURE, if it's Westinghouse."

Halt, It's I—Cobalt

The 200 mail carriers in the pneumatic tube mailing system at the plant of The Carborundum Company are now being tagged with radio-active cobalt. If a jam occurs, a man armed with a Geiger counter walks along the tube lengths and detects the culprit in a matter of minutes—instead of the hours formerly required to investigate 8000 feet of tubing in locating the jam.

Nolo is a Robot

If involved in an air-minded conversation where reference is made to a nolo flight, don't ask who piloted the plane—nolo being the abbreviation for "no live operator."

THE PUBLIC SEES THE PLANT—The leading characters of this TV scene consisted of mechanical presses all prettied up for their debut on a thirty-minute commercial program emanating from the Chevrolet plant in Cleveland. Cameras ground away through the plant as supervisors and employes in split second synchronization broadcast descriptions of actual operations to the unseen but seeing audience. Dollies facilitated the staging of the production, but no one bothered to crowd them at the end of the program!

News

California and Washington

HOWARD D. NEAL, general manager of the Aerol Co., Inc., Los Angeles, Calif., has been promoted to the office of vice-president. He will also continue his duties as general manager. The company, which manufactures wheels and wheel and caster assemblies, is soon to open a new foundry at 2424 San Fernando Road, Los Angeles, adjacent to its present quarters.

IPSEN INDUSTRIES, INC., Rockford, Ill., manufacturer of automatic heat-treating equipment, has opened a sales and service office at 120 E. Orange Grove Ave., Burbank, Calif., to meet West Coast demands. MRS. EVELYN TERWILLIGER is manager of the office; SIDNEY TERWILLIGER, sales engineer; and ROBERT L. TOEPFER, service engineer.

M. G. BROWN has been made assistant manager of the Los Angeles, Calif., branch of the Crucible Steel Company of America, New York City. Mr. Brown has been with the company since 1936, and three years ago was appointed supervisor of tool steel sales at the Cleveland, Ohio, office.

AMERICAN PULLMAX CO., INC., Chicago, Ill., announces the appointment of PAUL GRAY, 240 N. Reno St., Los Angeles, Calif., as West Coast representative for the sale of Pullmax sheet-metal working and flame-cutting machines.

KING-KNIGHT CO., 360 Jefferson St., San Francisco, Calif., has been appointed distributor for the 4FS Diesel engines made by Nordberg Mfg. Co., Milwaukee, Wis.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., have announced an expansion of the steel service facilities at their Spokane, Wash., plant. Approximately 10,000 square feet of working space will be made available for the addition of new reinforcing bar fabricating operations. The plant was formerly the Inland Empire Steel Co.

Colorado, Texas, and Utah

KURT ORBAN COMPANY, INC., New York City, has appointed the MINER MACHINE CO., Denver, Colo., distributor of the company's line of German-made machine tools in the states of Colorado, Wyoming, Utah, and New Mexico.

FIRTH STERLING, INC., has opened an office at 1102 Prudential Bldg., 1100 Holcombe Blvd., Houston 25, Tex., as headquarters for the new southwestern district. ROBERT B. LEWIS, who was Texas representative for the company, has been promoted to the post of manager of the district. This territory was formerly part of the southern district which has its office in Birmingham, Ala.

P. E. W. GOODWIN, JR., has been named manager of a new meter and valve plant to be opened this fall by the Rockwell Mfg. Co., Pittsburgh, Pa., at Sulphur Springs, Tex. Mr. Goodwin is currently manager of outside manufacturing facilities at Oakland, Calif.

PARKER APPLIANCE CO., Cleveland, Ohio, has appointed PACE-TURPIN & Co., Salt Lake City, Utah, distributor for tube fittings manufactured by the company.

Illinois

RODGER C. SWIFT has been appointed an abrasive engineer by the Norton Co., Worcester, Mass., and assigned to central Illinois. Mr. Swift had been covering the South American sales territory from Brazil at the time of his appointment. JOHN W. MCCUE, who formerly covered the central Illinois territory, has been assigned to the Chicago, Ill., area, filling the vacancy created by the appointment of WILLIAM N. JOVE to the staff of field engineers at the Chicago district office.

CLEARING MACHINE CORPORATION, Chicago, Ill., recently announced the appointment of three sales engineers who will represent the entire line of Clearing mechanical and hydraulic presses: JACK FREDERICKS, in Detroit, Mich., and its vicinity; WILLIAM MCKEOWN, Toledo and northern Ohio; and CARL BENSON, southern Ohio and eastern Indiana, with headquarters at the Hamilton, Ohio, plant.

MARSH B. HALL has been made chief engineer, and WILLARD S. COLLINS, assistant chief engineer, in the development and research engineering department at the Archer Avenue plant of the Acme Steel Co., Chicago, Ill. Mr. Hall replaces JAMES N. WOGNUM who was recently named chief engineer of the company's new engineering research laboratory.

WHEELCO INSTRUMENTS DIVISION, BARBER-COLMAN CO., Rockford, Ill., has recently added the following service engineers to Wheelco field offices: JAMES HEINLEN, Cincinnati, Ohio; JAMES J. HOFFMAN, JR., Cleveland, Ohio; D. J. PAKER, Omaha, Nebr., and VERNON N. JENNINGS, Tulsa, Okla.

WILBUR THIESS and HENRY KASHMAN recently joined G. S. Blakeslee & Co., Chicago, Ill., in the capacity of sales engineers. The former's territory will be southern Ohio and portions of Kentucky and West Virginia; and the latter's, New York City and Long Island.

THOMAS E. MCGUIRE has been appointed sales representative for the Billings & Spencer Co., Hartford, Conn., manufacturer of drop forged products. Mr. McGuire will have his headquarters in the company's Chicago, Ill., office.

MAGNAFLUX CORPORATION, manufacturer of testing equipment, has recently opened a plant at 7300 W. Lawrence Ave., Chicago, Ill., comprising 74,000 square feet—nearly twice the sizee of the plant formerly occupied in Chicago.

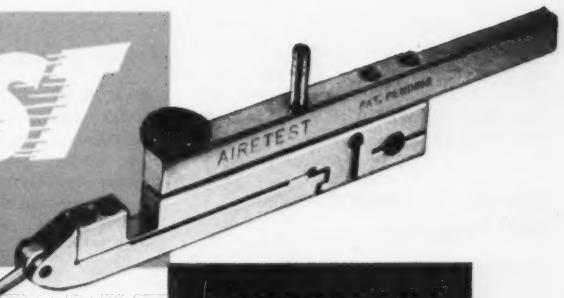
PHILIP C. COOKE was recently elected executive vice-president of the International Staple & Machine Co., Herrin, Ill. Mr. Cooke will continue to occupy the post of general manager which he has been holding.

METALLOID CORPORATION, Huntington, Ind., manufacturer of cutting, drawing, and grinding fluids, has opened an office at 753 W. 79th St., Chicago, Ill., with HAROLD SEXAUER directing field service and sales.

PRECISION DIAMOND TOOL CO., Elgin, Ill., having recently moved to its new plant located one-quarter of a mile east of Elgin, recently observed an open house celebration.

MONARCH MACHINE TOOL CO., Sidney, Ohio, announces that the Chicago, Ill., sales staff has moved to larger quarters at 6645 W. North Ave., Oak Park, Ill.

AIRETEST INDICATOR



REPETITIVE READINGS POSITIVELY ASSURED

ACCURACY Heretofore UNKNOWN in TOOL ROOM MEASURING

Readings at any point are identical whether approach is from front, back, or either side, with this new supersensitive AIRETEST precision indicator.

Free from HYSTERESIS—no lag, no drag—a movement of a few millionths is instantly indicated.

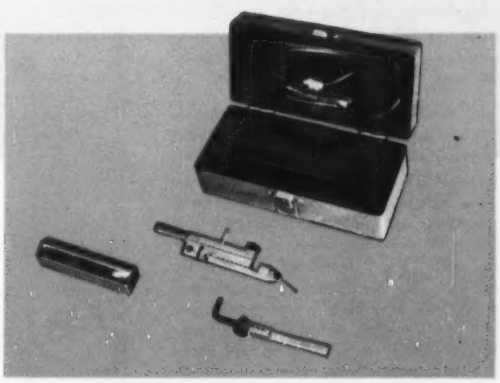
Cannot stick—the only movement is the flexing of a steel reed pivot—no gears, rack, cams, etc.

Much greater amplification—1,000, 2,000 or even 5,000 to 1, as contrasted with 400 to 1 of conventional indicators.

No figuring to correct for stylus angle—setting to a master block automatically corrects for angularity of stylus arm in that position. Calibration is quick.

"Pencil Slim" to enter hard-to-get-at places—easily goes into holes, slots, grooves, etc., impossible to get at with indicators.

GOES ON ANY STANDARD HEIGHT GAGE STAND



Order Now for Immediate Delivery of complete kit as shown, with or without Column Precisionaire instrument. Kit price $97.00. #1M or #2M Column Precisionaire, price $265.00, f.o.b. Dayton. Wire or write for demonstration in your plant.

6337

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

the **Sheffield** corporation
DAYTON 1, OHIO, U.S.A.

GAGES • MEASURING INSTRUMENTS
MACHINE TOOLS • CONTRACT SERVICES
THREADING TOOLS

REPRESENTATIVES IN PRINCIPAL COUNTRIES • In Australia, the Sheffield Corporation of Australia Pty. Ltd., Melbourne

RICHARD S. VAN NOTE has been made manager of the Chicago, Ill., office of the Selas Corporation of America, Philadelphia, Pa. He has been with the concern since 1949.

Maryland, South Carolina, and Alabama

RELIANCE ELECTRIC & ENGINEERING CO., Cleveland, Ohio, has established a branch office in Baltimore, Md., located at 13 W. 25th St. The office is staffed by A. C. SCHETTLER and W. C. MITCHELL, sales engineers.

ENGINEERING AND RESEARCH CORPORATION, Riverdale, Md., announces the establishment of a Material Planning and Control Division. JACK C. LIMOZAINE becomes superintendent of the Division.

BARBER-COLMAN CO., Rockford, Ill., announces the opening of a branch office in Columbia, S. C., located at 537 Harden St. ROBERT LINDSAY is manager of the new office, which will handle the sale of automatic control and air distribution products.

H. J. YARBROUGH has become manager of the Birmingham, Ala., branch of the Wall Colmonoy Corporation, Detroit, Mich.

Michigan and Indiana

CENTRAL STATES ENGINEERING CORPORATION and ACE TOOL & DIE CO., both of Detroit, Mich., have announced a joint service to design and build machinery and tooling, the former company handling the design work and the latter, the manufacturing of the equipment. Both companies will continue to work independently as in the past. JOHN ALLMON is president, and FRED W. GOLLBACH, chairman of the board, of the new company, to be known as the ACE-CENTRAL STATES MACHINE TOOL CO.

A. WARD JENKS has been made district manager in Detroit, Mich., for the Pittsburgh Crucible Division, Crucible Steel Company of America, New York City. Mr. Jenks will supervise sales in the Michigan territory of constructional alloy steels produced at the Midland Works. He replaces W. W. NOBLE, who retired on May 1. Mr. Noble was connected with the Crucible sales division since 1922, having been district manager at Cleveland, Pittsburgh, and Detroit.

CLARENCE W. FABEL has been appointed chief metallurgist of the Atkins Saw Division of Borg-Warner Corporation, Indianapolis, Ind. Mr. Fabel was formerly metallurgist and liaison engineer of the Simonds Saw & Steel Co., Fitchburg, Mass.

Missouri and Wisconsin

SAM E. GEWIN has been appointed district manager of the St. Louis, Mo., office of the Bristol Co., Waterbury, Conn., manufacturer of recording and controlling instruments. Mr. Gewin was a sales engineer at Buffalo, N. Y., at the time of his appointment.

WILLIAM S. SNEAD has been elected president and chairman of the board of the Emerson Electric Mfg. Co., St. Louis, Mo., and JOHN A. DRIY has been made executive vice-president.

BRUCE HERBERT has been made representative in Minnesota and Wisconsin for the Rollway Bearing Co., Inc., Syracuse, N. Y. Mr. Herbert has opened an office at 647 W. Virginia St., Milwaukee, Wis.

KARL A. BLIND has become assistant to the president of the Doerr Electric Corporation, Cedarburg, Wis., while CARL F. KOWAL has been made assistant sales manager.

New England

A. FRANCIS TOWNSEND has been appointed vice-president—engineering, and LAWRENCE H. COUSINEAU, vice-president—sales, by the Heald Machine Co., Worcester, Mass. Mr. Townsend joined the company in 1935, serving in various sales capacities, including that of manager of the Dayton, Ohio, office. In 1945, he became executive engineer at Worcester. Mr .Cousineau became associated with the company in 1942, and four years later was elected assistant treasurer, which office he will retain in addition to his new duties.

Roger S. Pyne, vice-president in charge of the Machine Tool Division for the Van Norman Co.

ROGER S. PYNE, sales manager of the Machine Tool Division of the Van Norman Co., Springfield, Mass., has been appointed vice-president in charge of the Division. Mr. Pyne has been with the company for thirty-nine years, and is a recognized authority on the grinding of ball bearings. For many years he supervised all designing, engineering, and sales of oscillating grinders for Van Norman. He was made sales manager of the Machine Tool Division in 1949.

CAMBRIDGE APPLIED RESEARCH, INC., 60 White St., Belmont, Mass., has recently been established for the purpose of improving and developing industrial products.

(Left) A. Francis Townsend, vice-president—engineering, of the Heald Machine Co.; (Right) Lawrence H. Cousineau, vice-president—sales and assistant treasurer of Heald

Revere offers you more than metal. You can benefit from our four-way collaboration, and we suggest you look into these extra services.

1. Revere salesmen often save customers money. They may recommend a less expensive alloy if it will serve as well as a more expensive one. Or they may suggest an extruded shape, costing more than plain bar, but saving important sums by reducing costly machining operations. They are capable of giving sound advice, because they are well trained and experienced, and take a sincere and informed interest in the welfare of buyers.

2. The Revere Technical Advisory Service was established by Revere over 20 years ago, as a nation-wide organization whose duty it is to collaborate with engineers, designers and production men, seeking ways to solve problems, cut costs, improve products, or all three.

3. The Revere Research Department operates a laboratory, staffed by engineers and scientists, and equipped with the latest scientific apparatus, including the spectrograph and X-ray diffraction. This Department is called upon by salesmen and Technical Advisors when they find it necessary to obtain thorough physical and chemical analyses, and base their recommendations upon such findings.

4. The Revere Mills, located in industrial centers from coast to coast, are an integral part of our organization, collaborating closely with the other three services. They give you exactly what you require, as to alloy, size, gauge, temper, finish, and their experience is often invaluable in helping to solve tough problems.

Please note that this four-way service, originated by Revere, does not take the place of your own engineers, designers or production men. It collaborates with them, confidentially. There is no charge or obligation. To obtain this service, get in touch with the nearest Revere Sales Office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

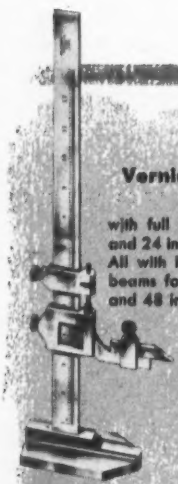
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities. Distributors Everywhere.

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

COPPER ★ BRASS ★ ALUMINUM

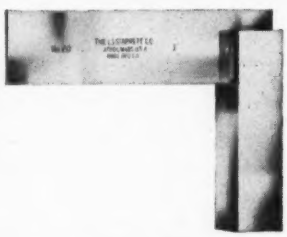
FOR QUICKER-SURER SET-UPS

These Starrett Tools help get machine tools into action quicker with unquestioned accuracy. Because they save time where time means big money, they pay for themselves over and over. They belong in every well equipped shop. Ask your Industrial Distributor about them.



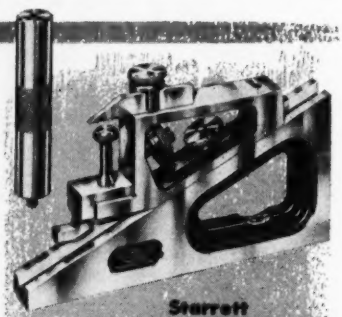
Starrett
Vernier Height Gage
No. 454

with full 12 inch range — 18 and 24 inch sizes also available. All with hardened and ground beams for lasting legibility. 36 and 48 inch gages furnished on special order. NEW No. 354 — 6 inch Height Gage with slotted base also available.



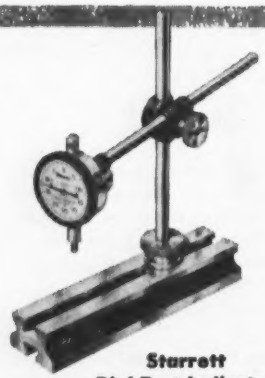
Starrett
Hardened Steel Square
No. 20

A precision square with hardened and accurately ground beam and blade edges. Many sizes from 1½ to 36 inches.



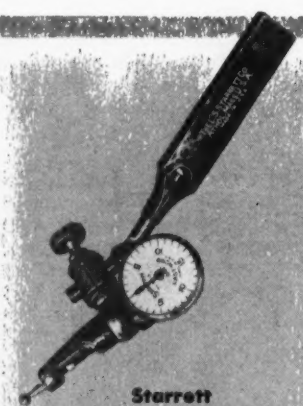
Starrett
Universal Precision Gage
No. 993 E (Patented)

Designed for machinists, toolmakers, gagemakers, inspectors and layout men. Combines the unique features of fine adjustment with universal adaptability to any gaging, scribing, measuring or leveling operation.



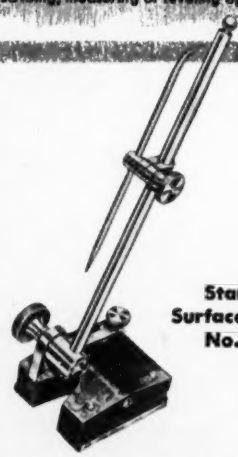
Starrett
Dial Test Indicator
No. 665

Attachments permit infinite adjustment on countless machining and inspection set-ups. Graduated .0005", reads 0-25-0, range .125".



Starrett
"Last Word" Test Indicator

A highly versatile test indicator for toolmakers, machinists, and set-up men. Available with holder on side or end of body.



Starrett
Surface Gages
No. 257

A universal gage for use on round work or flat surfaces. Available with 3" base and 9" or 12" spindle; also 3¾" base with 12" or 18" spindle.

STARRETT TOOLS

TRADE MARK

Starrett

REG U.S PAT OFF

SINCE 1880
WORLD'S GREATEST TOOLMAKERS

THE L. S. STARRETT COMPANY
Athol, Massachusetts, U. S. A.

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS, BAND SAWS and BAND KNIVES

Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR

Prompt delivery
Dependable service
Quality products

MACHINERY'S DATA SHEETS 731 and 732

WEIGHT OF BLUE-TEMPERED SPRING STEEL, PER LINEAL FOOT — 1

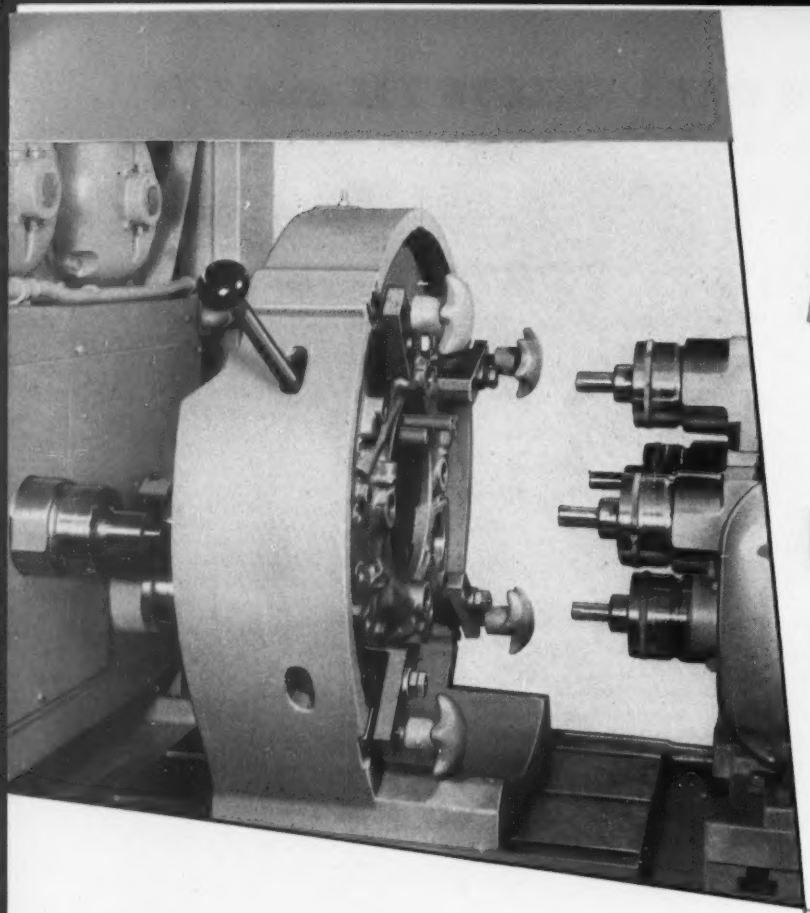
Width, Inches	Thickness, Inch															
	0.0015	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016
1/8					0.0021	0.0025	0.0029	0.0033	0.0038	0.004	0.0046	0.0051	0.0055	0.0059	0.0063	0.0067
1/4					0.0042	0.0050	0.0058	0.0066	0.0076	0.008	0.0092	0.0102	0.011	0.0118	0.0126	0.0134
3/8					0.0063	0.0075	0.0087	0.0099	0.0114	0.012	0.0138	0.0153	0.0165	0.0177	0.0189	0.0201
1/2					0.0084	0.0100	0.0116	0.0132	0.0152	0.016	0.0184	0.0204	0.022	0.0236	0.0252	0.0268
5/8					0.0105	0.0125	0.0145	0.0165	0.0190	0.020	0.0230	0.0255	0.0275	0.0295	0.0315	0.0335
3/4					0.0126	0.0150	0.0174	0.0198	0.0228	0.024	0.0276	0.0306	0.033	0.0354	0.0378	0.0402
7/8					0.0147	0.0175	0.0203	0.0221	0.0266	0.028	0.0322	0.0357	0.0385	0.0413	0.0441	0.0469
1	0.005	0.0068	0.0101	0.0135	0.017	0.0203	0.0238	0.027	0.0305	0.034	0.037	0.0408	0.044	0.0475	0.051	0.0543
1 1/8					0.0191	0.0225	0.0267	0.0303	0.0343	0.038	0.0416	0.0459	0.0495	0.0534	0.0573	0.061
1 1/4					0.0212	0.0253	0.0296	0.0336	0.0381	0.042	0.0462	0.051	0.055	0.0593	0.0636	0.0677
1 3/8					0.0233	0.0278	0.0325	0.0369	0.0419	0.046	0.0508	0.0561	0.0605	0.0652	0.0699	0.0743
1 1/2					0.0254	0.0303	0.0354	0.0402	0.0457	0.050	0.0554	0.0612	0.066	0.0711	0.0762	0.0811
2	0.010	0.0136	0.0202	0.0270	0.034	0.0406	0.0476	0.054	0.0610	0.068	0.074	0.0816	0.088	0.0950	0.102	0.1086
3	0.015	0.0204	0.0303	0.0405	0.051	0.0609	0.0714	0.081	0.0915	0.102	0.111	0.1224	0.132	0.1425	0.153	0.1629
4	0.020	0.0272	0.0404	0.0540	0.068	0.0812	0.0952	0.108	0.122	0.136	0.148	0.1632	0.176	0.190	0.204	0.2172
5	0.025	0.034	0.0505	0.0675	0.085	0.1015	0.119	0.135	0.1525	0.170	0.185	0.2040	0.220	0.2375	0.255	0.2715
6	0.030	0.041	0.061	0.081	0.102	0.122	0.143	0.163	0.183	0.204	0.224	0.245	0.265	0.285	0.306	0.326

MACHINERY'S Data Sheet No. 731, June, 1953 — Compiled by Alfred L. Snape

WEIGHT OF BLUE-TEMPERED SPRING STEEL, PER LINEAL FOOT — 2

Width, Inches	Thickness, Inch															
	0.017	0.018	0.019	0.020	0.021	0.022	0.023	0.024	0.025	0.026	0.027	0.028	0.029	0.030	0.031	0.032
1/8	0.0072	0.0076	0.008	0.0086	0.0089	0.0093	0.0097	0.0101	0.0106	0.0110	0.0114	0.0118	0.0123	0.0127	0.0131	0.0135
1/4	0.0144	0.0152	0.016	0.0172	0.0178	0.0186	0.0194	0.0202	0.0212	0.022	0.0228	0.0236	0.0246	0.0254	0.0262	0.027
3/8	0.0216	0.0228	0.024	0.0258	0.0267	0.0279	0.0291	0.0303	0.0318	0.033	0.0342	0.0354	0.0369	0.0381	0.0393	0.0405
1/2	0.0288	0.0304	0.032	0.0344	0.0356	0.0372	0.0388	0.0404	0.0424	0.044	0.0456	0.0472	0.0492	0.0508	0.0524	0.054
5/8	0.0360	0.0380	0.040	0.0430	0.0445	0.0465	0.0485	0.0505	0.053	0.055	0.057	0.059	0.0615	0.0635	0.0655	0.0675
3/4	0.0432	0.0456	0.048	0.0516	0.0534	0.0558	0.0582	0.0606	0.0636	0.066	0.0684	0.0708	0.0738	0.0762	0.0786	0.081
7/8	0.0504	0.0532	0.056	0.0602	0.0623	0.0651	0.0679	0.0707	0.0742	0.077	0.0798	0.0826	0.0861	0.0889	0.0917	0.0945
1	0.0576	0.061	0.0645	0.068	0.0713	0.0746	0.078	0.0815	0.0848	0.0881	0.0916	0.0951	0.0985	0.102	0.1053	0.1086
1 1/8	0.0648	0.0686	0.0725	0.0766	0.0802	0.0839	0.0877	0.0916	0.0954	0.0991	0.103	0.1069	0.1108	0.1147	0.1184	0.1221
1 1/4	0.072	0.0762	0.0805	0.0852	0.0891	0.0932	0.0974	0.1017	0.105	0.1101	0.1144	0.1187	0.1231	0.1274	0.1315	0.1356
1 3/8	0.0792	0.0838	0.0885	0.0938	0.098	0.1025	0.1071	0.1118	0.1166	0.1211	0.1258	0.1305	0.1354	0.1401	0.1446	0.1491
1 1/2	0.0864	0.0914	0.0965	0.1024	0.1069	0.1118	0.1168	0.1219	0.1272	0.1321	0.1372	0.1423	0.1477	0.1528	0.1577	0.1626
2	0.1152	0.122	0.129	0.136	0.1426	0.1492	0.156	0.1630	0.1696	0.1762	0.1832	0.1902	0.1970	0.204	0.2106	0.2172
3	0.1728	0.183	0.1935	0.204	0.2139	0.2238	0.224	0.2445	0.2544	0.2643	0.2748	0.2853	0.2955	0.306	0.3159	0.3258
4	0.2304	0.244	0.258	0.272	0.2852	0.2984	0.312	0.3260	0.3392	0.3524	0.3664	0.3804	0.3940	0.408	0.4212	0.4344
5	0.288	0.305	0.3225	0.340	0.3565	0.373	0.390	0.4075	0.424	0.4405	0.458	0.4755	0.4925	0.510	0.5265	0.543
6	0.346	0.367	0.387	0.408	0.428	0.448	0.468	0.489	0.509	0.529	0.550	0.571	0.591	0.612	0.632	0.652

MACHINERY'S Data Sheet No. 732, June, 1953 — Compiled by Alfred L. Snape



Another Way!

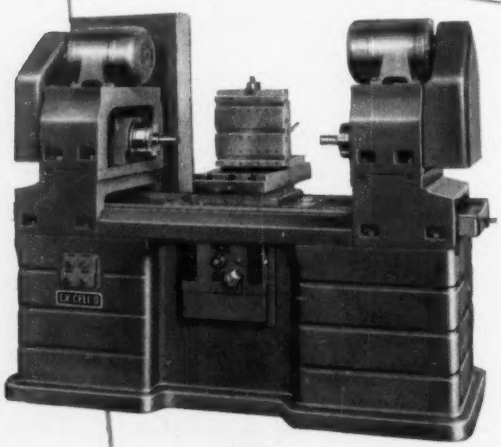
Relation of 7 Bores Held to Close Tolerances

The standard Style 17 Ex-Cell-O Precision Boring Machine shown above is equipped to finish-bore seven holes in a magnesium supercharger support. An individual spindle and a two-spindle cluster at the left end of the machine finish three holes, then four individual spindles at the right end finish the remaining holes—*all during one automatic work cycle.*

Bore diameters are held to plus or minus .0005″; relative location of holes is plus or minus .001″.

* * *

Call your Ex-Cell-O representative for complete information; or write Ex-Cell-O for Catalog 31205, with the complete story of Ex-Cell-O Precision Boring Machines.



The Style 17 is a rugged, double-end precision boring machine for accurate boring, turning and facing operations on medium-size and large workpieces. Shown above with Universal Fixture.

XLO

EX-CELL-O for PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS
CUTTING TOOLS • RAILROAD PINS AND BUSHINGS
DRILL JIG BUSHINGS • DAIRY EQUIPMENT
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

53-20

M. W. WILSON, product service manager of the Telechron Department, General Electric Co., Ashland, Mass., was recently made commercial engineer for the Department.

JEROLD L. WELCH has been made assistant chief engineer of the Reed-Prentice Corporation, Worcester, Mass.

Robert T. Frisbie, Jr., newly elected vice-president of the New Britain Machine Co.

ROBERT T. FRISBIE, JR., has been elected vice-president of the New Britain Machine Co., New Britain, Conn. Mr. Frisbie has been sales manager of the company's Machine Tool Division for the last four years, and has been with the concern for a period of sixteen years, first as salesman, then as New England representative.

PETER A. FRASSE & CO., INC., New York City, steel distributor, is now constructing an office and warehouse at Locust Street, Hartford, Conn. The new building will be devoted to the distribution of alloy, stainless, and cold-finished carbon steels and tubing in the New England area.

PAUL A. ROUSH, senior project engineer at the Flexible Tubing Corporation, Guilford, Conn., has been named manager of product development. Also announced was the appointment of KENNETH C. OESTREICHER as development engineer in the laboratory of the concern.

SEABOARD SCREW CORPORATION, West Warwick, R. I., manufacturer of machine and sheet-metal screws, recently completed an expansion program which was begun last year, increasing plant capacity 90 per cent.

New Jersey

H. K. PORTER CO., INC., Pittsburgh, Pa., which had acquired the Watson-Stillman Co., Roselle, N. J., last year, announces the separation of the fittings business (formerly known as Plant 2) from the hydraulic business (formerly called Plant 1). The addresses of the divisions to be operated as two separate concerns are as follows: Hydraulic Machinery—Watson-Stillman Co., Division of H. K. Porter Co., Inc., Box 26, Roselle; and the fittings business—Watson-Stillman Fittings Division, H. K. Porter Co., Inc., Box 95, Roselle.

M & N HYDRAULIC PRESS CO. recently moved to its new plant located at 780 Route 3, Clifton, N. J. The firm was formerly located at Allwood Road in Clifton, and was known for years as the M & N Machine Tool Works.

TRIANGLE CONDUIT & CABLE CO., INC., is completing a modern mill at New Brunswick, N. J. The company, which manufactures wire, cable, conduit, and plastic pipe, will also enter the copper and brass tubing field.

S. LEONARD SCHWARZ, assistant superintendent of shop operations in the North Plant of the De Laval Steam Turbine Co., Trenton, N. J., has been promoted to the position of plant superintendent.

CLIFTON HYDRAULIC PRESS CO., 296 Allwood Road, Clifton, N. J., is a company newly organized by MICHAEL BRODSKY. The company will produce the improved Clifpress hydraulic line of presses and equipment, and will also provide an engineering service. An export office will be maintained at 44 Whitehall St., New York City. Mr. Brodsky was formerly associated with the M & N Machine Tool Works.

Michael Brodsky, who has organized the Clifton Hydraulic Press Co.

ADAMAS CARBIDE CORPORATION, Harrison, N. J., is erecting a new million dollar plant for the production of tungsten-carbide tools, tool tips, dies, wear parts, and powder at Kenilworth, N. J.

GEORGE H. BINNS recently joined the Atlantic Casting & Engineering Corporation, Clifton, N. J., in the capacity of engineer.

J. DONALD BROWN recently joined the process development department of the Industrial Tape Corporation, New Brunswick, N. J.

New York

LYSLE B. MCKINLEY was elected vice-president in charge of scientific instrument sales, and CARL A. DAY, was made vice-president in charge of manufacturing by the Bausch & Lomb Optical Co., Rochester, N. Y. Mr. McKinley became associated with the company in 1929, and since 1947 has been sales manager of the Scientific Instrument Division. Mr. Day joined the company in 1931, and for ten years was also in this Division. In 1942, he transferred to the Manufacturing Division, where later he was promoted to works manager of all Rochester manufacturing, production control, and plant maintenance activities. In 1947, he established the company's eyeglass frame plant at Wellsville, N. Y. He was also responsible for completing the development of the lens plant at Midland, Canada.

APPARATUS SALES DIVISION OF THE GENERAL ELECTRIC CO., Schenectady, N. Y., announces the establishment of two new sales districts: an Empire District with headquarters at Syracuse, N. Y., with WILLIAM J. WOODS as manager; and a Pacific Southwest District at Los Angeles, Calif., with EDWARD M. ELLIS as manager. The Pacific Southwest District will have offices at Bakersfield, Los Angeles, Riverside, and San Diego, Calif., and Phoenix and Tucson, Ariz. This territory had been part of the Pacific District. The Empire District will include offices at Albany, Binghamton, Elmira, Jamestown, Niagara Falls, Rochester, Syracuse, and Utica—an area formerly covered by the New York District.

L. E. GRUBB has been appointed general superintendent of the Huntington, W. Va., Works of the International Nickel Co., Inc., New York City. Mr. Grubb was formerly general superintendent at the Bayonne, N. J., Works, and this position will be filled by P. H. FLYNN, who was

assistant superintendent there at the time of his promotion. Mr. Grubb has been associated with the company since 1937, and was general superintendent at Bayonne since 1942, the same year in which Mr. Flynn became assistant superintendent.

JOHN C. STEERE has been named district sales manager for Rhode Island by the International Machinery Division of British Industries Corporation, New York City. Mr. Steere, who is located at 177 First St., Pawtucket, R. I., was formerly associated with the Brown & Sharpe Mfg. Co. Another announcement made was the appointment of RICHARD FRASER as district manager in the Pittsburgh, Pa., area. His office will be in the Triangle Bldg., Pittsburgh.

B. C. AMES CO., Waltham, Mass., announces the appointment of G. W. BRUNTON & SON, INC., 2315 Elmwood Ave., Kenmore, N. Y., as agent in the Buffalo, Rochester, Syracuse, and Elmira areas of New York State. In addition to acting as sales representative for Ames micrometer dial indicators and gages, the representative will maintain an engineering service.

CHARLES A. SIMMONS, SR., who founded the Simmons Machine Tool Corporation, Albany, N. Y., in 1910 and has been its president since, was recently elected chairman of the board. His son, CHARLES A. SIMMONS, JR., who was vice-president and general manager of the corporation, succeeds him as president. The latter has been with the organization for the last twenty years, working in every phase of the concern's operations. The Simmons Machine Tool Corporation is devoted to the rebuilding and reconditioning of machine tools, and is also building new special-purpose machinery.

E. H. HORSTKOTTE has joined the Michigan Oven Co., Detroit, Mich., builder of industrial ovens, in the capacity of engineering consultant in the Schenectady, N. Y. area. His office will be located at 1554 Union St., Schenectady. Mr. Horstkotte recently retired from the General Electric Co. after forty years of service with that company.

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y., recently appointed the DOALL EASTERN CO., INC., 67 Lexington Ave., New York City, as a dealer for Bausch & Lomb industrial optical instruments for quality control. DAVID A. MOREINIS is in charge of the new DoAll service.

DR. HOWARD L. BENDER, assistant director of the Research and Development Department, Bakelite Co., a Division of Union Carbide and Carbon Corporation, New York City, recently received the twelfth annual John Wesley Hyatt Award "for achievement of wide importance to the plastics industry."

FRANKLIN P. HINMAN has been advanced to the post of product manager of the Electronic Tube Division at Elmira, N. Y., by the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Hinman joined this Division in 1951 and was maintenance superintendent at the time of his promotion.

THOMAS D. CARTLEDGE, president of the Linde Air Products Co., and HOWARD S. BUNN, president of the Bakelite Co., both companies being Divisions of Union Carbide and Carbon Corporation, New York City, have been elected vice-presidents of the Corporation.

WALTER F. SCHMID has become assistant general sales manager of the DeLaval Separator Co., Poughkeepsie, N. Y. He was formerly manager of the company's Refrigeration Division in New York City.

JOHN D. WILLIAMS has been elected vice-president and general manager of Rollway Bearing Co., Inc., Syracuse, N. Y., succeeding WILLIAM B. SMITHERS, who recently retired.

JUDSON C. TRAVIS, vice-president and general manager of Handy & Harman, refiners and fabricators of precious metals and their alloys, New York City, was recently elected president of the company.

JULIUS SALOWAY, manager of the Liquidation Division of the Morey Machinery Co., Inc., New York City, has just been elected a director.

THOR POWER TOOL CO., Aurora, Ill., announces the removal of its Buffalo, N. Y., office to a new building at 735 Military Road in Buffalo.

THEODOR WUTSCHER has been named chief designer of the Rolling Mill Division of Hydropress, Inc., New York City.

Ohio

W. A. MATTIE, superintendent of the Heater Division of the Eaton Mfg. Co., Cleveland, Ohio, was recently promoted to the position of general manager of the Division, following the recent death of C. C. BRADFORD. R. F. GAMUNDI becomes superintendent, filling the vacancy created by Mr. Mattie's promotion. Mr. Gamundi was chief design engineer in the Central Research Division prior to his transfer to the Heater Division.

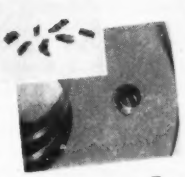
METAL CARBIDES CORPORATION, Youngstown, Ohio, has opened a sales office at 325 Bankers Trust Bldg., Indianapolis, Ind., with FRANK C. THOMPSON, JR., as sales engineer, and another office at 743 N. Fourth St., Milwaukee, Wis., with CHARLES ROMAN as sales engineer. Also announced was the appointment of FRED WINTER, JR., sales engineer for the Boston, Mass., office.

WILLIAM W. TAYLOR has joined the OPW Corporation, Cincinnati, Ohio, maker of valves and fittings, becoming vice-president in charge of manufacturing operations. Mr. Taylor was formerly associated with the Cincinnati Milling Machine Co.

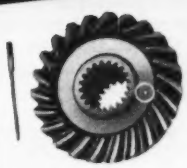
(Right) Charles A. Simmons, Sr., chairman of the board of the Simmons Machine Tool Corporation; and (Left) Charles A. Simmons, Jr., new president of the Corporation.

METAL DISINTEGRATION

and what it can do for you . . .

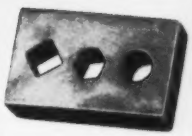


Remove Broken Taps fast without distortion

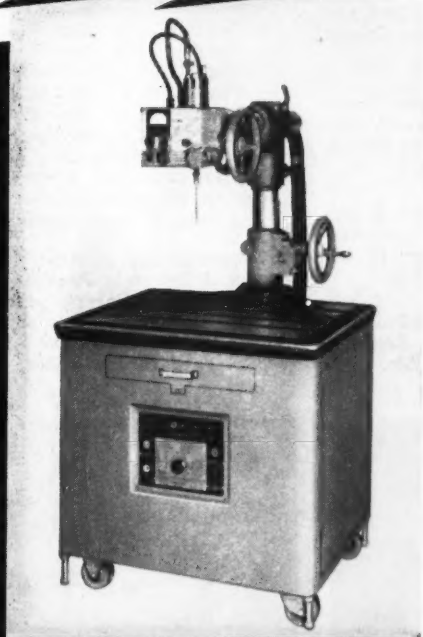


Cut oil holes in hardened gears without annealing

Cut dovetails in hardened dies



Cut any shape hole in cemented carbides



Literally hundreds of thousands of dollars are saved annually by corporations that are using Metalmasters in just tool and die repair alone.

There's a technical engineer in your area to give you an on-the-spot demonstration in your own plant at your convenience. (NOTE: It is not uncommon to pay for a Metalmaster with just one short demonstration thru savings on workpieces.)

For information as to the Metalmasters' uses and benefits merely write today on your company letterhead to:

Metalmaster

DIVISION OF CLINTON MACHINE COMPANY

CLINTON, MICHIGAN

Carl M. Beach, newly elected director and vice-president of Cincinnati Milling & Grinding Machines, Inc.

CARL M. BEACH, domestic sales manager of the Cincinnati Milling Machine Co., Cincinnati, Ohio, was recently elected a director and vice-president of the company's sales subsidiary, Cincinnati Milling & Grinding Machines, Inc. Mr. Beach has been with the company since 1929. At first, he worked in various shop departments, then became a sales engineer, and finally Detroit office manager. In 1949, he was made assistant sales manager, and two years later domestic sales manager.

E. W. BLISS CO., Canton, Ohio, manufacturer of presses, rolling mills, and special machinery, announces the election of the following vice-presidents: RICHARD Y. MOSS, vice-president and manager of the Canton, Ohio, Division; ROBERT SHANNON, vice-president and manager of the Hastings, Mich., Division; and ALBERT E. WHYMAN, vice-president in charge of European operations.

JOHN W. CRAIG was recently elected president of Aluminum Industries, Inc., Cincinnati, Ohio, producer of all types of aluminum castings and automotive parts. Mr. Craig will also be general manager of the company's two plants in Cincinnati. He was formerly vice-president of the Avco Mfg. Corporation and general manager of its Crosley Division.

JACK C. DILLING was recently appointed manager of the Indianapolis, Ind., sales office of the Berger Mfg. Division, Republic Steel Corporation, Cleveland, Ohio. Mr. Dilling, who was a sales engineer for the Division at Detroit, Mich., succeeds ROBERT N. GRIFFITH. Mr. Griffith has been made manager of the shelving sales department at Canton, Ohio, headquarters of the Division.

T. F. PATTON, vice-president and general counsel of the Republic Steel Corporation, Cleveland, Ohio, has been elected to the newly created position of assistant president and first vice-president of the Corporation.

JOHN V. EAKIN has been made general manager of the Fawick Airflex Division of the Federal Fawick Corporation, Cleveland, Ohio.

INTERNATIONAL RESEARCH & DEVELOPMENT CORPORATION recently moved into larger quarters at 168 Hosack St., Columbus 7, Ohio.

M. R. BATES has been named sales engineer by the Alloy Precision Castings Co., Cleveland, Ohio.

Pennsylvania

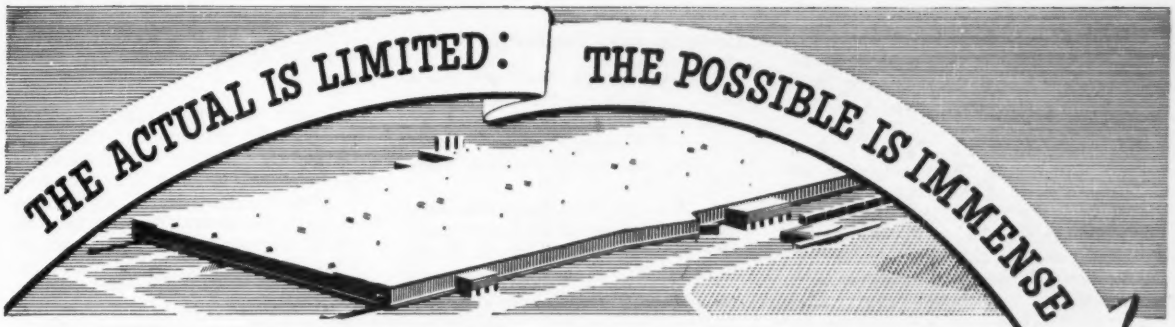
GENERAL ELECTRIC CO., Schenectady, N. Y., has announced the following appointments in its Switchgear and Control Division, Philadelphia, Pa.: General managers—CLARENCE E. BURKE, high voltage switchgear department; H. FRANK HENTSCHEL, medium voltage switchgear department; and REGINALD H. JONES, low voltage switchgear department; and managers of staff departments—VERNON L. COX, engineering department, and EDWIN M. BRAMWELL, financial department.

WESTINGHOUSE ELECTRIC CORPO- come director of works engineering for the Headquarters Manufacturing Division of the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Wendelken has had a long career in works engineering for the corporation, having become associated with Westinghouse in 1917 at the East Pittsburgh Works in the power plant department. At the time of his present promotion, he was chief electrical engineer of the Headquarters works engineering department.

ROBERT J. STEELE has been made general superintendent of the Carbide Division and JOHN D. KNOX, superintendent of the Powdered Metals Division, by Firth Sterling, Inc., Pittsburgh, Pa. Mr. Steele was superintendent of the Powdered Metals Division at the time of his appointment in the Carbide Division, while Mr. Knox was a project engineer in the research department at the time of his promotion.

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh, Pa., has begun construction of a factory near Pittsburgh that will complete parts for atomic power plants. The building, which is to occupy 87,000 square

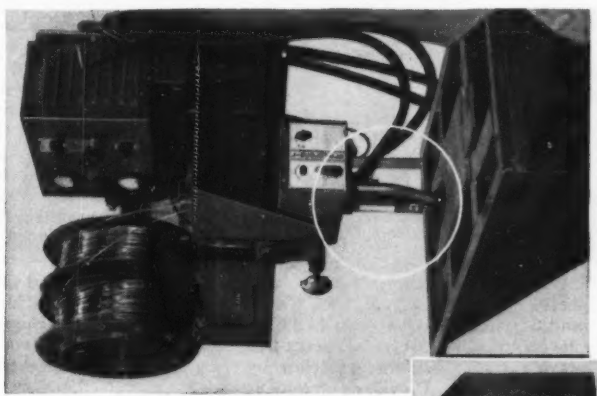
(Left to right) Richard Y. Moss, Robert Shannon, and Albert E. Whyman, newly elected vice-presidents of the E. W. Bliss Co.

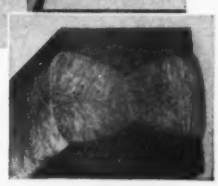


NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1953

"TWINARC'S" FASTER, LOWER COST WELDING BOOSTS SHOP EFFICIENCY





IT is now possible to realize savings up to 35% in the cost of automatic welding with Lincoln's new "TWINARC". Welds have deeper penetration, greater uniformity . . . and are produced at *speeds 50% higher* than possible with single electrode automatic welding.

Reports from code welding fabricators indicate quality superior to conventional automatic processes.

With "TWINARC", welding currents up to 1200 amps are concentrated on two small diameter electrodes (Fig. 1). These electrodes can be set in line with the work for tandem welding to attain maximum penetration at high speed. For welding thin material or assemblies with poor fitup the "TWINARC" head may be rotated in any position to 90 degrees across the joint to spread the arc, reducing the danger of burning through.

"TWINARC" welding is only one of many new Lincoln developments designed to cut your costs. Have your representative survey your needs and recommend latest Lincoln techniques to speed welding, to simplify your operations and save money.

Fig. 2. Automatic Lincolnweld LAF-2 *with new "TWINARC" attachment. "TWINARC" replaces original single electrode jaws. Operates with same single controls. Inset shows butt weld in 1-¼" plate with single pass on each side with "TWINARC". Welding speed is 38% faster than possible with single electrode.*

INCREASES WELDING SPEEDS 50% AND HIGHER! TO CUT YOUR COSTS

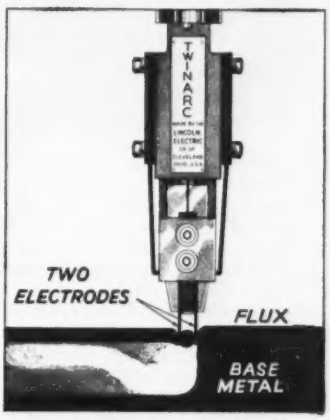


Fig. 1. New Lincoln "TWINARC"... *feeds two continuous electrodes simultaneously for faster, more efficient "hidden arc" welding in granular flux.*

Results... utilizes currents up to 1200 amps, produces deeper penetration, higher quality welds, at lower cost.

HANDLES A WIDER RANGE OF WORK

ANOTHER LINCOLN FIRST

GET THE FACTS — *Bulletin on "TWINARC" welding giving latest speeds and procedures is available by writing on your letterhead to Dept. ...*

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

feet of floor space, will house the newly formed atomic equipment department of the Westinghouse Atomic Power Division.

R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, announces the appointment of the Sales & Service Machinery Co., 3818 Chestnut St., Philadelphia, Pa., as sales representative for the complete line of LeBlond lathes and lathe attachments in eastern Pennsylvania, southern New Jersey, Maryland, the District of Columbia, and Delaware.

Erickson Tool Co., Cleveland, Ohio, manufacturer of precision holding tools, has opened a Mid-Atlantic Division office at 32 Rittenhouse Place, Ardmore, Pa. Robert F. Lotz has been appointed manager of the new office. The Division will cover eastern Pennsylvania, Delaware, and Maryland.

John D. Thompson has been elected executive vice-president of Henry Disston & Sons, Inc., Philadelphia, Pa., manufacturers of saws, tools, and alloy steels. Mr. Thompson was formerly associated with John A. Roebling's Sons Co., Trenton, N. J., having been vice-president in charge of operations there.

Burns George, vice-president in charge of sales, Vanadium-Alloys Steel Co., Latrobe, Pa., has been named recipient of the 1953 McFarland Award for Achievement in Metallurgy by the Pennsylvania State College Chapter of the American Society for Metals. This award is presented annually to an outstanding metallurgy alumnus.

J. Donald Clark and George Nessenthaler have become general manager and works manager, respectively, of the George K. Garrett Co., Philadelphia. Their duties will extend over the three company plants located in Philadelphia and Ellwood City, Pa.

Jerome G. Brady has been made manager of the Pittsburgh, Pa., district for Kennametal Inc., Latrobe, Pa. Mr. Brady has been a sales engineer for the company in the northern New York area for the last six years.

Humbert C. Cozza, Jr., has become manager of industrial engineering in the Lewis Machinery Division of Blaw-Knox Co., Pittsburgh, Pa., and John A. Deer, has been appointed manager of production planning and control.

George Sall Metals Co., Inc., has opened a plant at 2300 E. Butler St., Philadelphia, Pa., for the manufacture of non-ferrous metal ingots from scrap materials. George Sall heads the company.

Canada and England

Lebanon Steel Foundry, Lebanon, Pa., has opened an office at 304 Crescent Bldg., 1411 Crescent St., Montreal, Quebec, Canada. Vincent J. Doyle represents Lebanon there.

J. William Robinson has been named manager of the new Canadian branch of the F. J. Stokes Machine Co., Philadelphia, Pa. His office is located at 1179 Decarie Blvd., Montreal, Quebec.

Paul H. Lahr was recently appointed European service engineer for the Monarch Machine Tool Co., Sidney, Ohio. Mr. Lahr will make his headquarters in London. Mr. Lahr has been servicing all types of machine tools for seventeen years, principally in England.

Obituaries

Walter P. Zagar

Walter P. Zagar, founder and president of Zagar Tool, Inc., Cleveland, Ohio, died on April 23 in Cleveland at the age of sixty-five years. Mr. Zagar, an Austrian by birth, was a Cleveland resident

Walter P. Zagar

since 1913. He had been employed as a machinist at the White Motors Co. for twenty-five years prior to opening a machine shop in 1939 in order to build a special machine. His son became associated with him in this project and the new company expanded rapidly. During the war, his wife also became active in the company. Mr. Zagar was a member of the American Society of Tool Engineers and the Cleveland Tool and Die Association. He is survived by his wife, his son, Frank, general manager of the concern, and three daughters.

James W. McLaughlin, vice-president of the Union Carbide and Carbon Corporation, New York City, died suddenly on May 15 at his home in New Rochelle, N. Y., at the age of sixty-two years. He was born in Paris, Ill., and was graduated in 1914 from the University of Illinois. For many years Mr. McLaughlin was connected with Prest-O-Lite and Linde Air Products Company plants, early operations of Union Carbide, in the Middle West and on the Pacific Coast.

In 1927, he was transferred to the South Charleston, W. Va., plant of the Carbide and Carbon Chemicals Company, where he became assistant superintendent, and later general superintendent of this company's plants. Made a vice-president of the Carbide and Carbon Chemicals Company in New York City in 1931, he became associated with the plastics activities of the company, and, in 1944, was named president of the Bakelite Company. A year later, he was elected vice-president of the Union Carbide and Carbon Corporation, and in 1952, became chairman of the Bakelite Company. Mr. McLaughlin is survived by his wife, a son, and a daughter.

Oscar C. Schmitt, president and director of Emerson Electric Mfg. Co., St. Louis, Mo., died on April 21, after a heart attack, at the age of fifty-nine years. Mr. Schmitt joined the company in 1910. Following various sales and executive assignments, he was elected a vice-president in 1936. In 1940, he became executive vice-president, and five years later, president.

W. Edgar Spear, chairman of the board of the Chiksan Co., Brea, Calif., died after a short illness on May 4 in Pasadena, Calif., at the age of sixty years. He had been president of the company from 1942 till 1952 when he became chairman.

* * *

Film on Jet-Engine Blades

A 16-millimeter sound moving picture on the production of blades for jet engines has been released by the Utica Drop Forge & Tool Corporation, Utica, N. Y. Films are available for schools and public groups without cost. The motion picture covers the entire manufacturing process from the sinking of forging dies through the various steps of forging, machining and inspection. A wide variety of blades is shown being manufactured so as to enable a description of as many different types of operations as possible. The film was produced in cooperation with the Carborundum Co.

We Invite * Comparison

Watson-Stillman 1250 Ton
Aluminum Extrusion Press.

Send for Extrusion Bulletin 340-A

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In fact, here's an extrusion press *so* outstanding—in features, performance, and production—that we urge you to stop, look and listen to all other offers.

Only in this way can you fully appreciate the overwhelming superiority of this Watson-Stillman 1250 ton aluminum extruder over anything else in its class.

Seeing is believing. Don't decide on paper, or on the basis of reports one time or more removed from the source. Drop us a line and we'll arrange for you to visit one of the many leading plants equipped with Watson-Stillman presses.

Watch them at work. Talk to the men whose production and profits depend on Watson-Stillman Presses. You will understand why *Watson-Stillman Extruders Lead the Field.*

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DIVISION OF H. K. PORTER COMPANY, INC.

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New Books and Publications

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1953). 8400 pages, 9 by 14 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York 1, N. Y. Price, $15 (upon renewal, $12.50).

More than 70,000 products, covering all lines of manufacture in the United States, are classified in the forty-third edition of this informative purchasing encyclopedia. The material is published in three volumes, in addition to the index, or finding list, which facilitates convenient reference to the work.

The first two volumes list the names and addresses of manufacturers classified by products. The products are classified not only by generalized group names but by specific types, so that the prospective buyer can easily find the particular type that will meet his requirements. The names of the manufacturers under each product classification are arranged by states and cities, thus making it easy for a buyer to select a product within certain geographical boundaries if desired. All classifications are thoroughly cross-indexed. A capacity or capital investment rating is given for each firm at each product listing.

The third volume contains an alphabetical list of manufacturers with branches, subsidiaries, and other data such as company officials and cable codes. It also gives an alphabetical list of trade names, together with export and other miscellaneous information.

Buyers, sales managers, research departments, production executives, and all those who require a list of products or names of manufacturers for various purposes will find this "where to buy" source an invaluable aid.

MACRAE'S BLUE BOOK. 4127 pages, 8 1/2 by 11 inches. Published by MacRae's Blue Book Co., 18 E. Huron St., Chicago 11, Ill. Price in the United States and Canada, $15; foreign, $20.

Now in its sixtieth edition, this book is a buying guide and annual directory covering all the manufactured products in the United States. There are three sections in the book. The first comprises an alphabetical list of the names and addresses of over 50,000 manufacturers of various products, including, in many cases, names of officers and local distributors. This section is also supplied in a separate paper-bound book —a feature aimed to permit dual use of the data in busy offices.

The second and main part of the book is the classified material section containing 3650 pages and listing all manufacturers of a given product under the name of the product. These classifications are thoroughly subdivided, for easy reference to the particular type of equipment desired. The last section consists of an alphabetical list of more than 60,000 trade names of the products included in the classified material section.

This book will prove useful to sales departments, purchasing agents, and all those who need to make up a list of industrial concerns or products for any purpose.

HISTORY OF STRENGTH OF MATERIALS. By Stephen P. Timoshenko. 452 pages, 6 by 9 inches; 245 illustrations. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $10.

This book is based on a series of lectures given by the author over the last twenty-five years to students in engineering mechanics who had completed courses in strength of materials and theory of structures. Handled chronologically, the development of the science of strength of materials is traced through historical periods beginning with the Seventeenth Century when the first attempts to find the safe dimensions of structural elements were made. Within these periods, major contributions made by prominent scientists and engineers are described in brief biographies in order to give a complete and vital picture of developments.

Discussions bring together the progress of the science of strength of materials in relation to contemporary engineering education and industrial practices in various countries. Considerations include the effect of railroad transportation, the use of steel as a major structural material, and the development of combustion engines and light airplane structures.

APPLIED KINEMATICS (Third Edition). By J. Harland Billings. 352 pages, 6 by 9 inches; 321 figures. Published by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. Price, $4.50.

Written for second- or third-year engineering students who have had the prerequisite mechanics portion of physics and a first course in calculus, the text serves as a foundation for machine design and for all courses concerned with machines and equipment for production and power. It is a particularly useful preparatory study for undergraduate and graduate courses in servomechanisms and analogue computers.

INTRODUCTORY ENGINEERING MATERIALS. By Irving H. Cowdrey and E. L. Bartholomew, Jr. 424 pages: 5 3/4 by 8 1/4 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, $6.

An elementary and descriptive treatment of engineering materials is the intention of the authors in preparing this text for the use of students on the college level. Materials, what they are, and the relationships between structures, treatments, and properties are handled concisely. Photomicrographs of metallic structures are used to show how internal structures result from certain composition and properties, and in turn determine the mass characteristics. Now terms are explained as they are used. A list of books for suggested reading and a visual bibliography (of motion pictures and film strips) are included.

BORON STEEL, 114 pages, 8 1/2 by 11 inches. Published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. Price, $1 (paper-bound).

A collection of sixteen articles reprinted from *Metal Progress* on boron steel. An introductory article in the booklet consists of a verbatim panel discussion held during the 1951 Western Metal Congress under the title "Saving Precious Alloys by Intelligent Use of Alternatives."

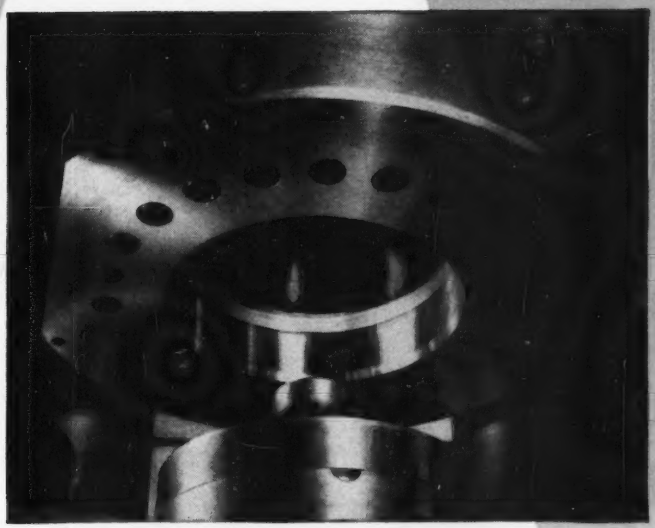
AMERICAN STANDARD INVOLUTE SPLINE AND SERRATION GAGES AND GAGING (ASA B5.31-1953). 22 pages, 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.25.

Coming Events

JUNE 1-3—Annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at the Homestead, Hot Springs, Va. Executive Secretary, John C. Sears, Empire Bldg., Pittsburgh 22, Pa.

JUNE 16-19—National Spring Technical Meeting and Welding and Allied Industry Exposition of the AMERICAN WELDING SOCIETY at the Shamrock Hotel, Houston, Tex. Executive secretary, J. G. Magrath, 33 W. 39th St., New York 18, N. Y.

JUNE 28-JULY 2—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Statler, Los Angeles, Calif. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.



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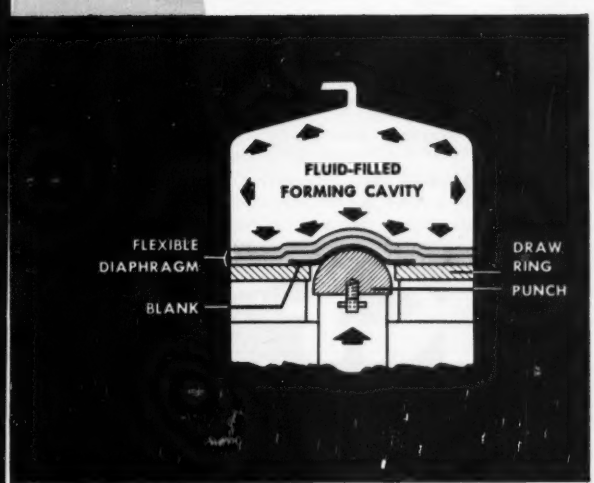
OF COLD DRAWN PARTS... THE HEART OF THE Hydroform



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Sheet metal parts are literally squeezed into shape by this built-in feature of the Cincinnati Hydroform. It is a fluid-filled forming cavity sealed by a flexible diaphragm to which wear pads are cemented to reduce wear. The flexible die member takes the place of more than half the parts of a conventional draw die.

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Diaphragm life is dependent upon part shape, depth of draw, and type and thickness of the material being drawn. Life can range up to 15,000 or more pieces. Prompt replacement of the wear pad when worn will prolong flexible diaphragm life.

The diaphragm is held in the forming cavity with a simple snap ring and can be changed in less than 30 minutes.

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Tool costs are greatly reduced; fewer operations are required; part quality is materially improved... these are but a few of the important advantages of this simplified deep drawing process. Let a Cincinnati Milling field engineer give you complete information. Write for Bulletin M-1759-2.

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KEEPS DIRT OUT

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- SKF Triple-Seal "SAF" Pillow Blocks are easy to install and inspect.
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When you have a bearing replacement to make, call your SKF Distributor. He'll show you *why* you will minimize bearing trouble with SKF Triple-Seal "SAF" Pillow Blocks. Remember—your SKF Distributor is a bearing *specialist*.

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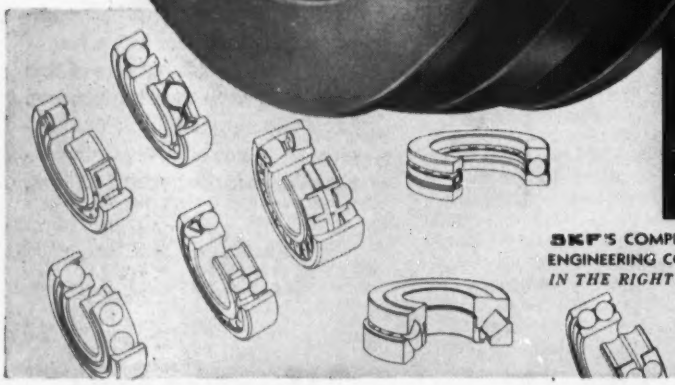

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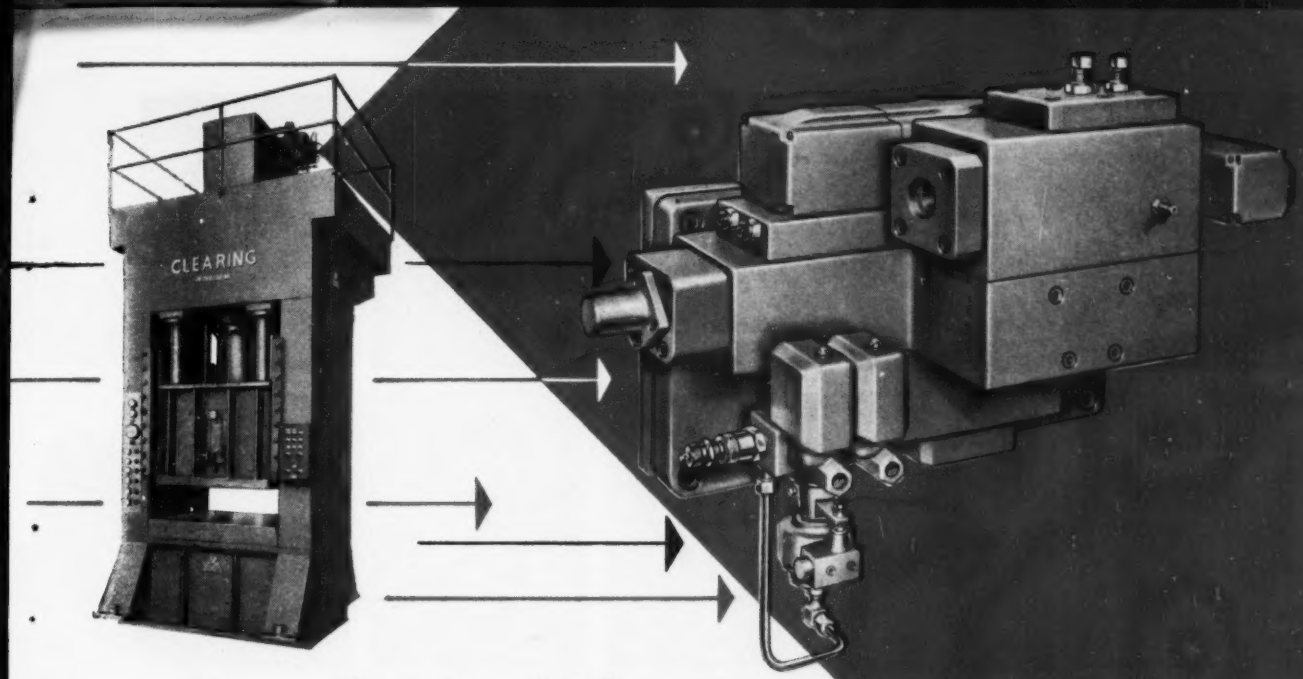

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Valve bodies are cut from solid steel forged blocks and all chambers and ports are bored from solid—there can be no harmful distortion. Corrosion resistant, chrome plated valve spools are free to move without the possibility of binding.

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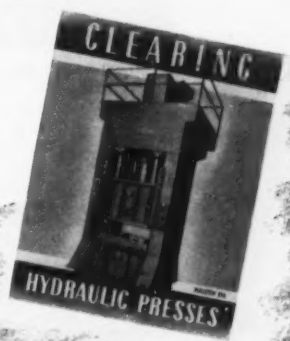

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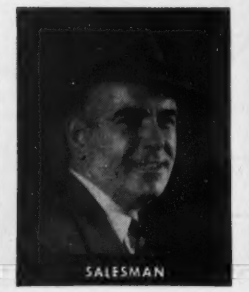
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DISTRICT MANAGER

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OFFICE MANAGER

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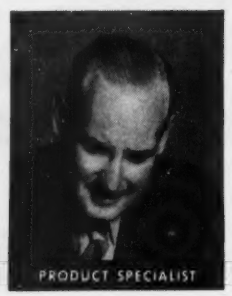
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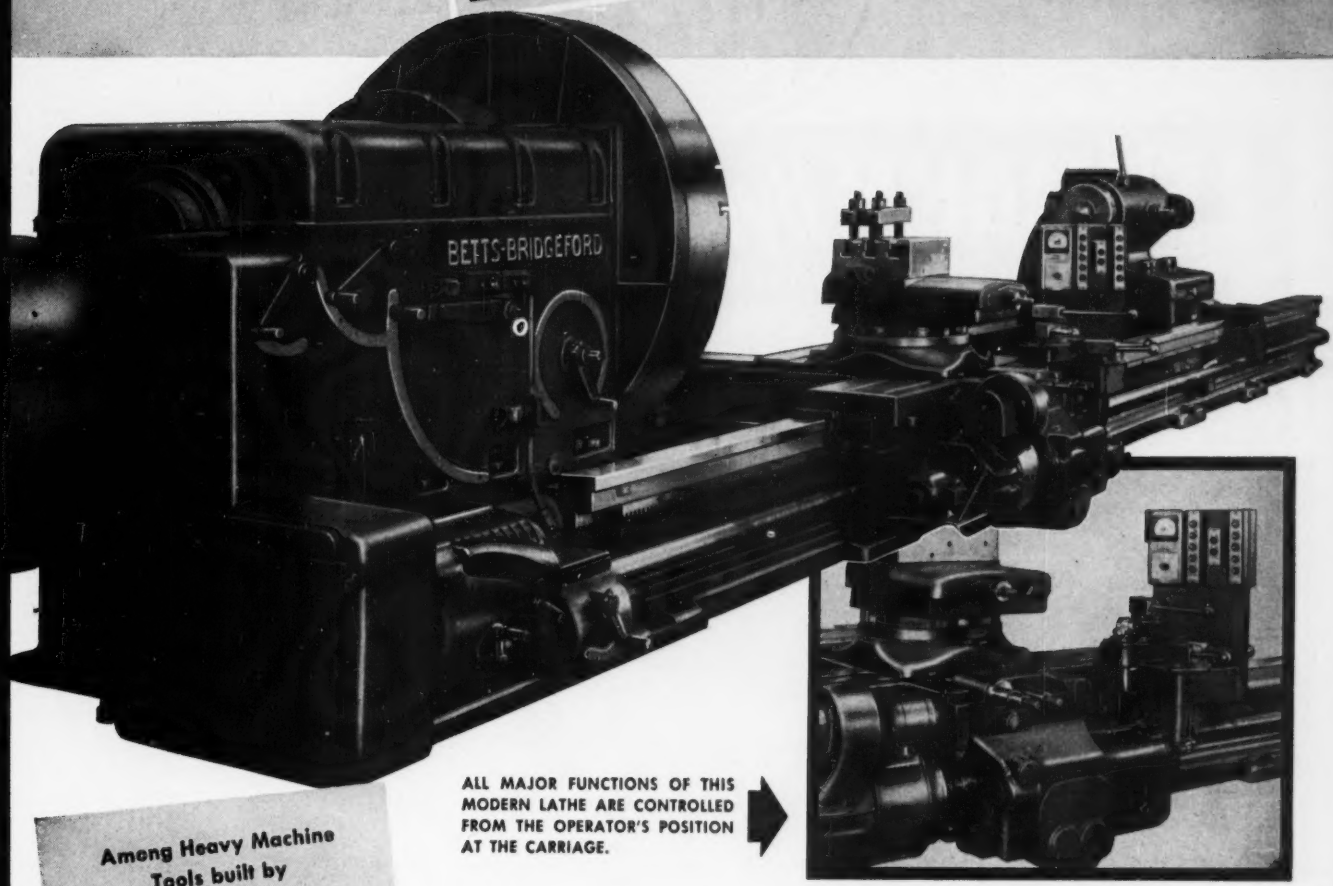

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- Wide speed range permits use of either high speed steel or carbide tools.
- Feed and traverse functions entirely independent of thread cutting mechanism.
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- Lead screw for thread cutting only.
- All anti-friction bearing headstock.
- Hardened steel bedways.
- Main drive motor speeds and feed and traverse functions are conveniently controlled from the operator's position at the carriage.
- Altogether, this modern lathe embodies the advanced features necessary to meet today's demand by industry for high production with greater accuracy and durability. Full information on this lathe or other Betts-Bridgeford Heavy Duty Lathes from 26" to 144" and larger will be furnished upon request.

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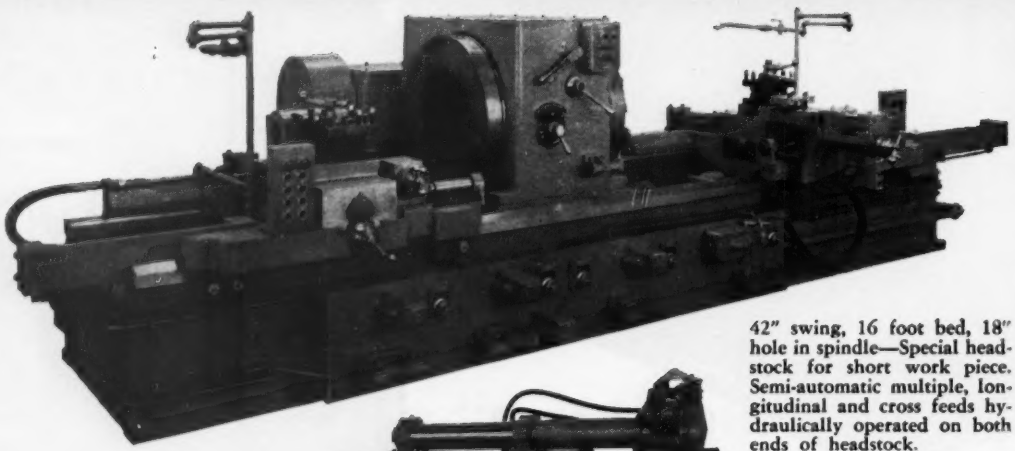
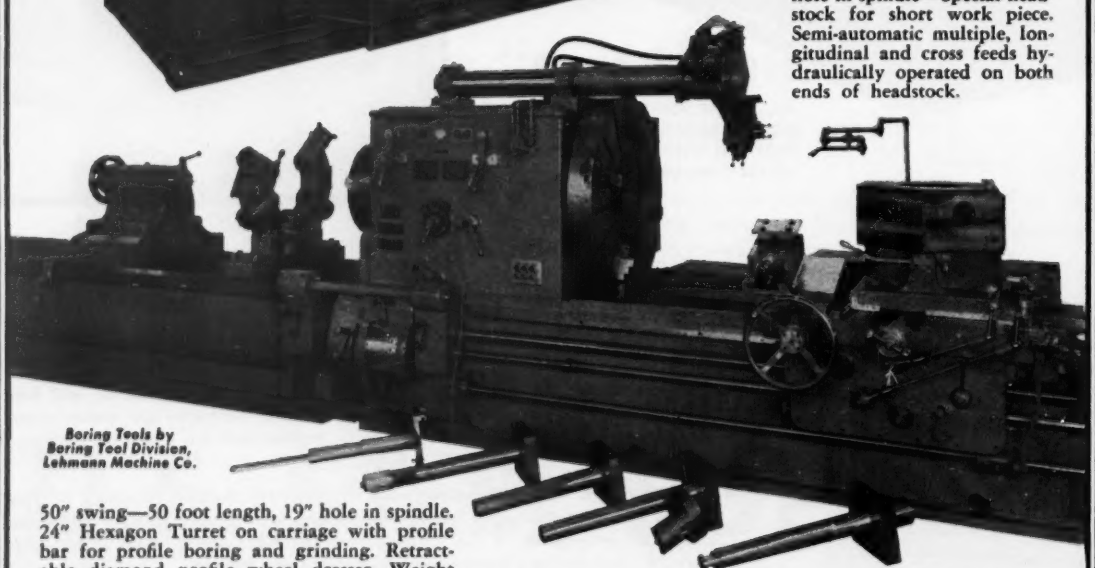
LEHMANN *Hydratrol* LATHES

LARGE HOLLOW SPINDLE — DOUBLE END TYPE



42" swing, 16 foot bed, 18" hole in spindle—Special headstock for short work piece. Semi-automatic multiple, longitudinal and cross feeds hydraulically operated on both ends of headstock.



Boring Tools by Boring Tool Division, Lehmann Machine Co.

50" swing—50 foot length, 19" hole in spindle. 24" Hexagon Turret on carriage with profile bar for profile boring and grinding. Retractable diamond profile wheel dresser. Weight 72,000 lbs.

Double End Hydratrol Lathes are built in sizes from 18" with holes up to 7⅛" to larger sizes with holes to suit the job. Double End operations avoid necessity for resetting the work, and insure relative concentricity of boring and turning operations and squareness of faces at both ends.

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CARBIDE END MILLS

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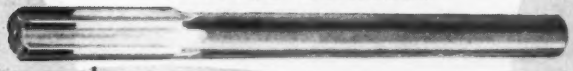

CARBIDE SPECIAL TOOLS

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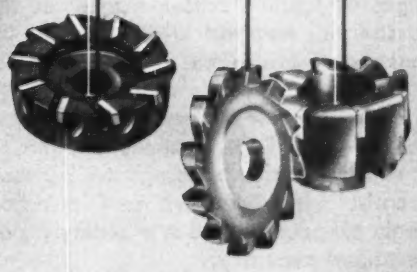
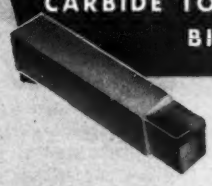


CARBIDE TOOL BITS



The Super line of carbide tools features aggressive and up-to-the-minute thinking in cutting tool design. More than 50 items in a complete range of sizes are carried in stock in warehouses conveniently located in New York, Detroit, Chicago and Los Angeles.

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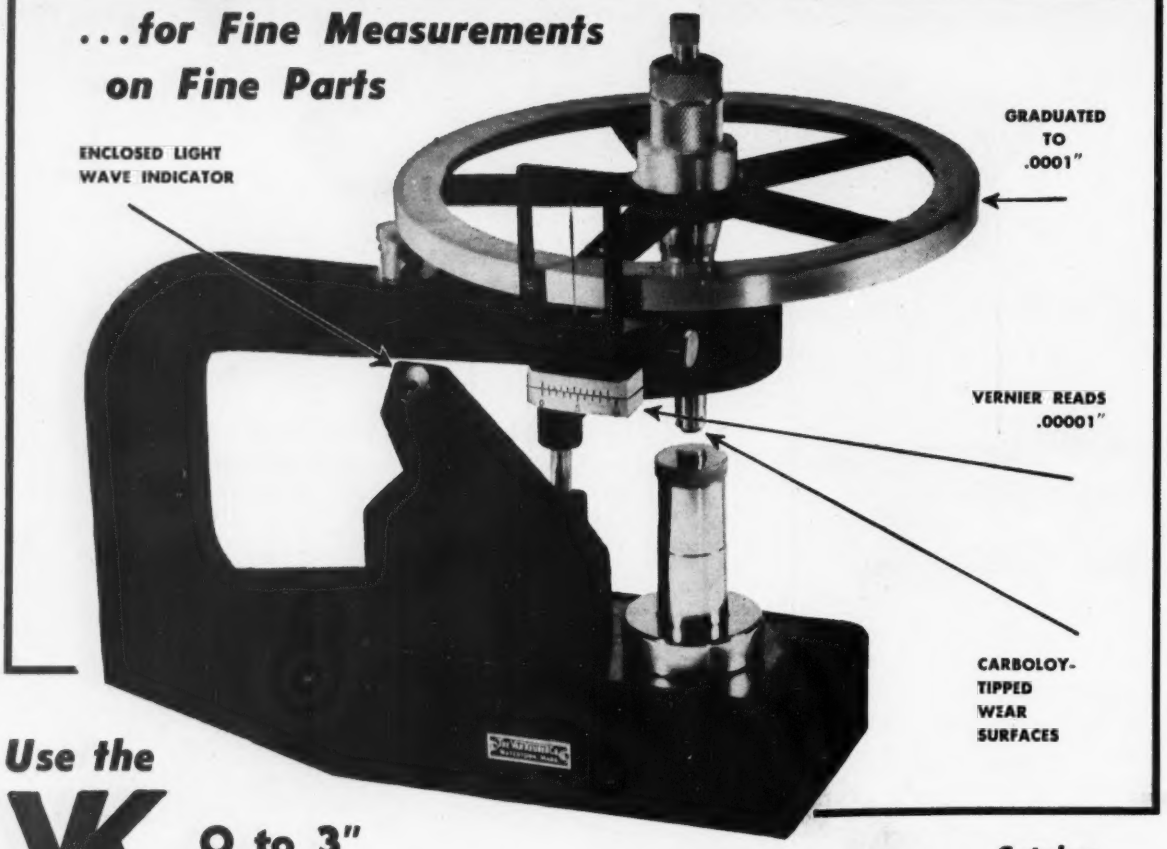

Use the VK 0 to 3" LIGHT WAVE MICROMETER

The Van Keuren Light Wave Micrometer is an instrument of exceptional accuracy, ideal for measuring plug gages or small precision parts. Use it when you're after "that last hundred thousandth" involved in so many of today's measurements. The 0 to 3" instrument shown above has a ½" diameter, 40 threads per inch micrometer screw, which can be made with greater accuracy, and which has 3 times the wearing surface of an ordinary micrometer screw. It has an 8" diameter micrometer wheel .0001" graduations 1/10" apart. It has a non-parallax vernier index which enables readings to be made to .00001". It has an index lock and carboloy-tipped anvil and spindle. This sturdy, sensitive instrument weighs only 17 pounds, and is in reality a portable measuring machine of inbuilt and sustained accuracy.

The Light Wave Micrometer is not a comparator. No gage blocks are needed and no errors creep in from worn blocks. It is a direct source of dependable precision . . . fast, accurate and profitable.

Catalog and Handbook No. 35

This 220-page volume represents years of research by the Van Keuren Co. It presents a simple and exact method of measuring screws and worms with wires, tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods. Ask for your copy . . . sent free on request by writing: The Van Keuren Company, 178 Waltham St., Watertown, Mass.

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Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires

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Built into every Card tap are years of concentration on one ideal — to build the best taps money can buy.

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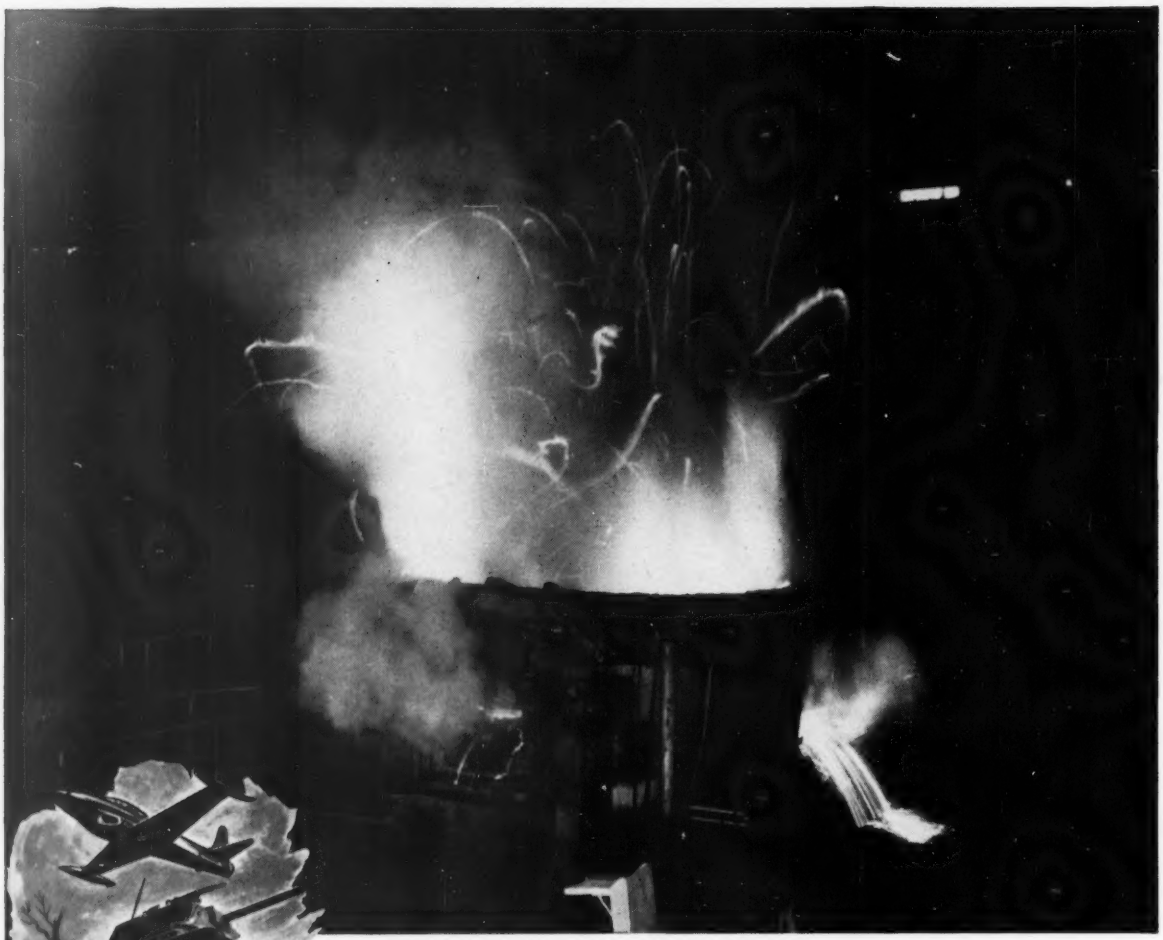
by Morton Berger
UNION TWIST DRILL COMPANY • ATHOL, MASSACHUSETTS
Milling Cutters Gear Cutters Twist Drills Hobs Reamers Carbide Tools
OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.
BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec



Special Steels for Armament for Industry for the Home

Spectacular Beginning of a SPECTACULAR STEEL

An electric furnace puts on a terrific show when we drop in a charge (as above) but it's only indicative of the great performance the steel will give later in service. For these are the high-alloy steels, stars of the metal world . . . the steels that give you so much more than they cost in resisting corrosion, heat, wear or great stress—or in providing special electrical properties. ● They can help *you* cut costs, improve quality, or add sales appeal. Let's get together on it. ***Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.***

WAD 4149 B

PIONEERING on the Horizons of Steel

Allegheny Ludlum

AL
LEADING PRODUCER HIGH-ALLOY STEELS

Warehouse stocks of A-L Stainless carried by all Ryerson plants

An open letter to potential buyers of special machine tools and special tooling

Now, we can offer you greatly expanded facilities for the solution of your specific metalworking problems

FOR 55 years we've been designing and building special machine tools — as well as tooling and adaptations for standard equipment. But because of limited facilities, we could serve only a minimum number of you as customers in this ever expanding and increasingly important market.

Frankly speaking, we have decided that the time has come when we must be able to serve more of you. To do this job right, we are now completing a $5,000,000 plant expansion to handle this work — to help you solve your special production problems with special machinery and special tooling, big — or small.

Here are our qualifications:

EXPERIENCE: We've been in the business 55 years. During that time we have designed and built over 60,000 standard and special machine tools. *In recent years, our production of special machinery has ranged up to four million dollars annually.*

FACILITIES: Our new expansion is devoted exclusively to the production of special machinery. The new plant, built on a site covering 38 acres, is equipped with *over $2,500,000 worth of the very latest tools and equipment* — many of them custom-built for the job.

PERSONNEL: Our Special Machinery Division engineering section has at its command nearly *100 experienced, imaginative and practical design and project engineers* . . . men fully qualified in the sciences of applied mechanics, hydraulics, electronics and metallurgy . . . and metalworking.

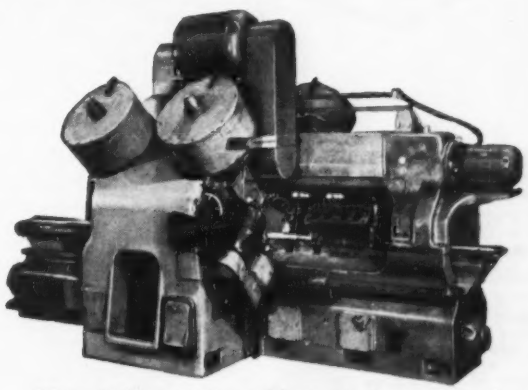
PERFORMANCE: Kearney & Trecker's Special Machinery Division is best recommended by its outstanding record of successfully solving many hundreds of unusual machining problems . . . problems that involved demands for high volume production, as well as exacting dimensional accuracy and fine surface finish.

RESPONSIBILITY: Our Special Machinery Division is an integral part of the Kearney & Trecker Corporation . . . and is fully supported by all its financial and physical resources. Any commitment for a product of this division is a commitment that fully involves the accepted reputation for responsibility and satisfaction that is Kearney & Trecker's.

We invite your inquiry

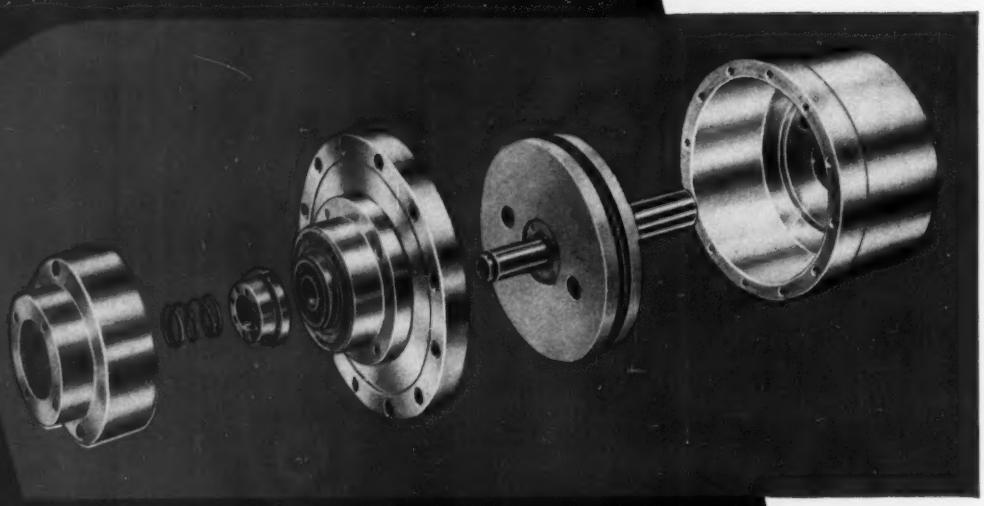
We'll be glad to provide you with any information we can . . . including sample machine specification sheets on typical installations, a brochure covering the expanded facilities of our Special Machinery Division, and details on our Customer Engineering Service. Furthermore, if you have special production machinery problems, have one of our senior Project Engineers analyze them, without obligation, of course.

Write, wire or phone the Special Machinery Division, Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.



We've built special machines or adaptations of standard equipment for practically every industry. Here is a photo of a transfer-type milling machine we designed and built for a major automotive manufacturer.

CUSHMAN



ALUMINUM AND IRON BODY AIR CYLINDERS

CONSERVE YOUR MAN-POWER

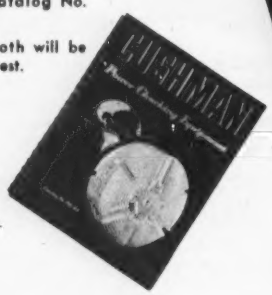
Simple, powerful, and trouble-free in operation, Cushman Rotating Air Cylinders set an entirely new standard for performance. Balanced and with few, rugged moving parts, they operate up to highest required speeds. Cushman engineers have also succeeded in perfecting the air control and power system to the point where applied pressures can be held dependable under production line operating conditions.

Any air chuck is completely dependent upon the efficiency of its operating air cylinder. Cushman Iron Body Rotating Air Cylinders have been designed to safeguard the performance of Cushman Precision Air Chucks, but may be used with other types too. Cushman Aluminum Body Rotating Air Cylinders provide equivalent performance at speeds up to the highest now being used. Low maintenance and long service life are inherent in this simplified design. Consult your distributor or write us direct for further information.

The Cushman Air Chuck Catalog No. PO-64-1952 covers our complete line of Air Chucks, Cylinders, and Accessories.

Cushman Manually Operated Chucks are separately described and listed in Catalog No. 65-1952.

Either or both will be sent on request.



THE CUSHMAN CHUCK COMPANY
815 WINDSOR STREET
HARTFORD 2, CONNECTICUT, U. S. A.
Chucking Engineers Since 1862

Manufacturers of
AIR CHUCKS, CYLINDERS, and ACCESSORY EQUIPMENT • THE CUSHMAN POWER WRENCH • CUSHMAN MANUALLY OPERATED CHUCKS and FACE PLATE JAWS.

A WORLD STANDARD FOR PRECISION

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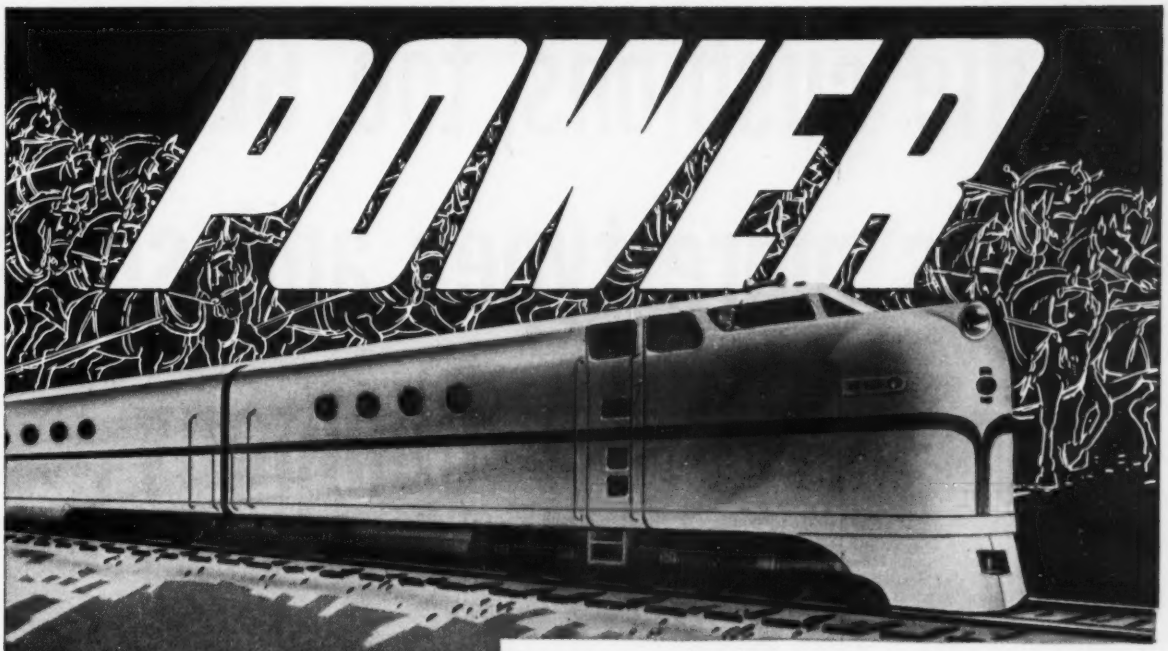

delivered by Microhoned Surfaces

. . . Diesel principle and the Microhoning process combine to help produce the most efficient engine in the world!

Because diesel engine parts must be able to bear and deliver tremendous power, important load-carrying surfaces are Microhoned.

The Microhoning process develops a surface that can withstand intense force. There is no torn, burned or smeared metal that might flake or wear off quickly. All the bores are round, straight and accurate to close tolerances.

THAT'S WHY—the cylinder liner,
—the cross head,
—the connecting rod . . . all which must hold the compression and transmit the terrific thrust are MICROHONED!

For more information on Microhoning, write for free copies of *Cross Hatch*.
Address Field Engineering B-4,
8100 Schoolcraft, Detroit 4, Michigan

PRECISION PRODUCTION THROUGH MICROHONING
MICRO MATIC
TRADE MARK

MICROHONING—STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

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REPRESENTATIVES: Overgard Machine Tool Company, 234 Commonwealth Bldg., Denver 2, Colorado
Hallidie Machinery Co., 2726 First Ave., South, Seattle, Wash. • REPRESENTATIVES IN ALL PRINCIPAL COUNTRIES

In die cushions, too, BLISS builds more types and sizes than any other company...

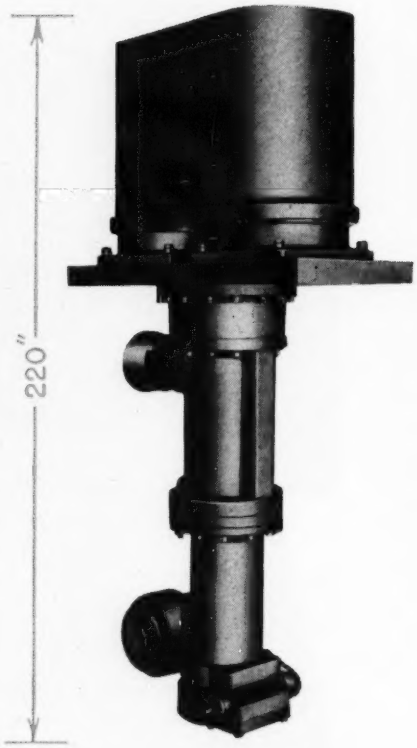
Bliss-Marquette Die Cushion Engineering Ranges from Standard "A" and "C" Types for Punch Presses to large Specials like this Hydro-Pneumatic

The *right* die cushion for a given application can make a lot of difference in press operation. That's why Bliss engineers have created a multitude of types and sizes to suit individual situations. Bliss designs have demonstrated their effectiveness over many years by...

- ***Permitting deep draw operations at low cost***
- ***Eliminating operations***
- ***Prolonging die life***
- ***Reducing spoilage***
- ***Preventing excessive strains***
- ***Adding another action to presses***

Since these cushions can eliminate many difficulties and make possible substantial savings, *all Bliss S-1, S-2 and Inclinable presses are designed and machined to accommodate them.* Bliss cushions are easy to install, easy to maintain and easily adjusted for work involving any pressures within their capacities.

Bliss builds die cushions in a large number of types and sizes to meet practically any possible condition. You're likely to find the cushion to suit your particular need in Bliss' 60-page Reference Book on types, uses and care of die cushions. Write for your copy.



E. W. BLISS COMPANY, CANTON, OHIO

E. W. Bliss (England) Ltd., Derby, England

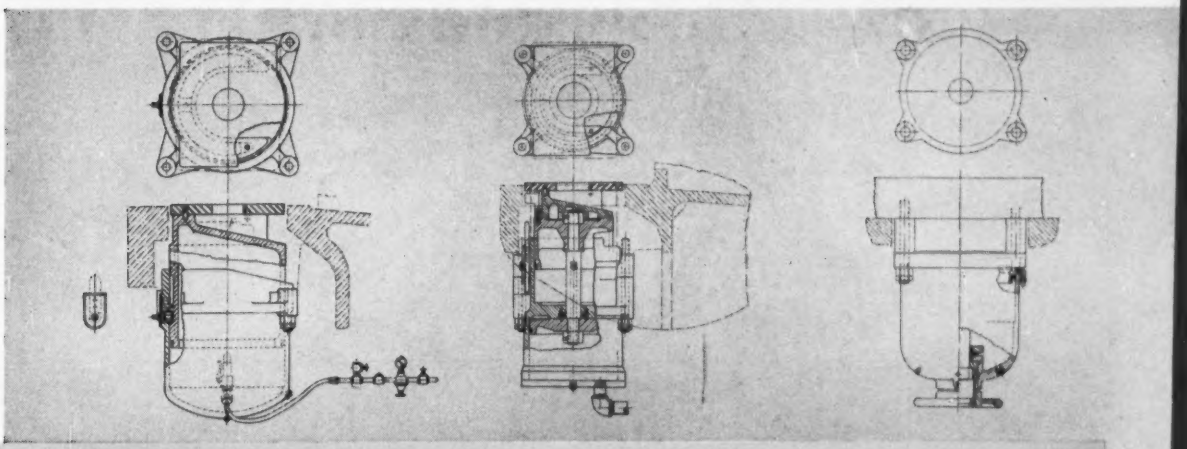
E. W. Bliss Company (Paris), St. Ouen sur Seine, France

U. S. Plants in Canton, Salem and Toledo, Ohio; and Hastings, Michigan
Branch offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. West Coast Representatives: Moore Machinery Co., Los Angeles and San Francisco; Star Machinery Company, Seattle. Other dealers in United States cities and throughout the world.

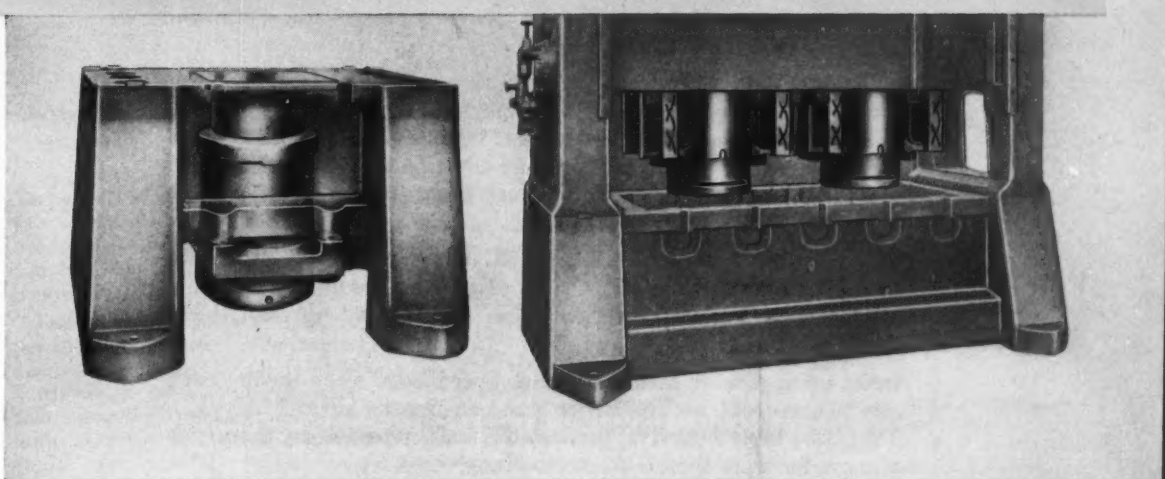
Remember: **for DIE CUSHIONS, Presses,**

FOR INCLINABLE PRESSES Bliss makes a complete series of pneumatic cushions; Type CO (left), requiring no tank for standard strokes; Type CCO (center), requiring a tank only when stroke is over 2", similar to Type CO but with two pistons and cylinders to deliver greater pressures; Type GA (right), having a hollow piston shaft for easy slug removal, self-contained for strokes up to 1".

Note that Type CO and CCO cushions are arranged with openings in the pressure pad to suit the job so that slugs or scrap may be dropped through the die.



Why these Bliss-Marquette Die Cushions for inclinable and straight side presses can improve press room efficiency

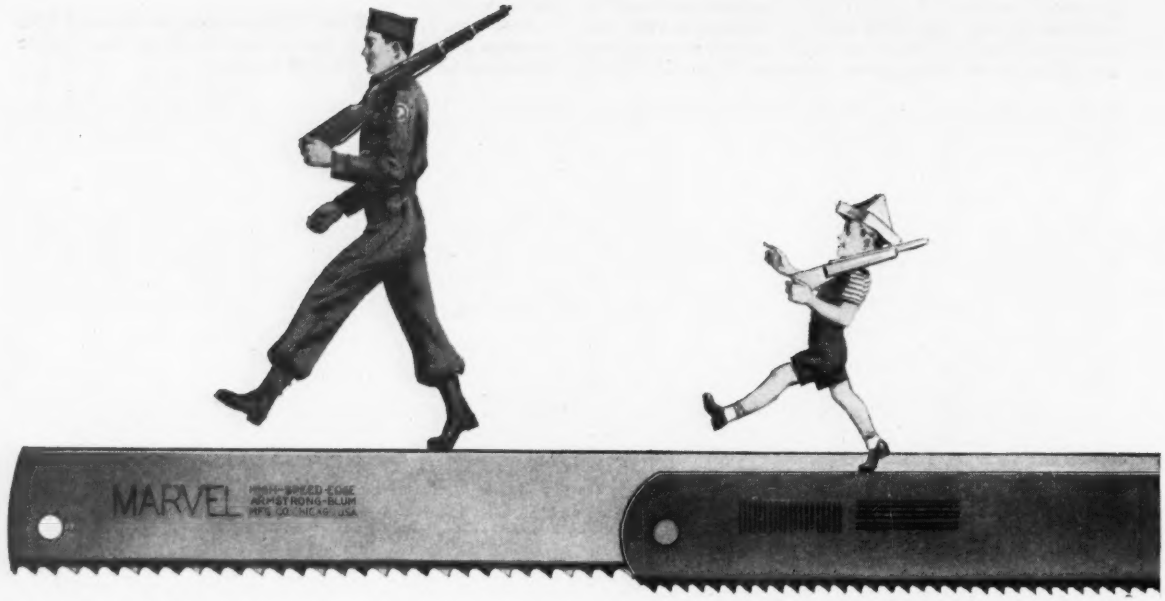


FOR S-1 PRESSES Bliss recommends Type CC cushions which feature extra long internal guides to prevent side movement or weaving of the pressure pad. Locking devices can be furnished.

FOR S-2 PRESSES Bliss recommends Types C and CC cushions. The compact design of Type CC permits installation of a double cushion that will draw up to 8".

Rolling Mills, Special Machinery...

It's Bliss



. . . *but*
Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate — without the "know-how" of MARVEL EXPERIENCE . . .

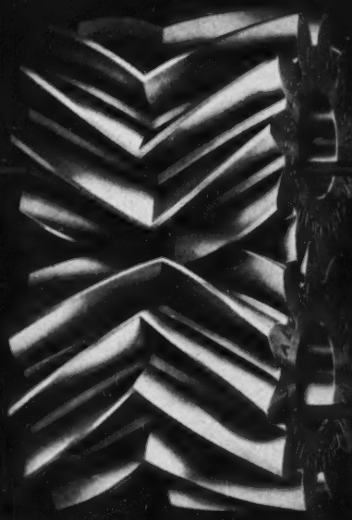
Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

MARVEL *Metal Cutting* SAWS

Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. · 5700 Bloomingdale Ave. · Chicago 39, U. S. A.

WHAT ARE YOU LOOKING FOR IN GEARS?



SMOOTH,

VIBRATION-FREE PERFORMANCE?

LONG LIFE?

QUIET OPERATION?

You get *all* of these in Farrel-Sykes gears — because they are *all* the product of precision generation, plus high-grade materials, plus the herringbone design.

Farrel-Sykes gears are made of the finest-grade materials available. They are generated by the famous Farrel-Sykes method — a process that assures extreme accuracy of tooth spacing, contour and helix angle.

The herringbone design provides evenly distributed pressure over each tooth, from tip to working depth line. This means that there is no tendency for the contour of the teeth to wear unevenly and thus shorten the life of the gears.

Wherever power transmission must be smooth, quiet, and vibrationless under all conditions of load and speed, *specify Farrel-Sykes herringbone gears.* Information and engineering assistance available, without obligation.

Farrel-Sykes herringbone gears are made in any size from ¼" to 20' 0" diameter, for any power capacity and speed. Also available are straight tooth and single helical gears in sizes up to 20 feet diameter, and large internal gears with either spur or helical teeth.

FARREL-BIRMINGHAM COMPANY, INC.

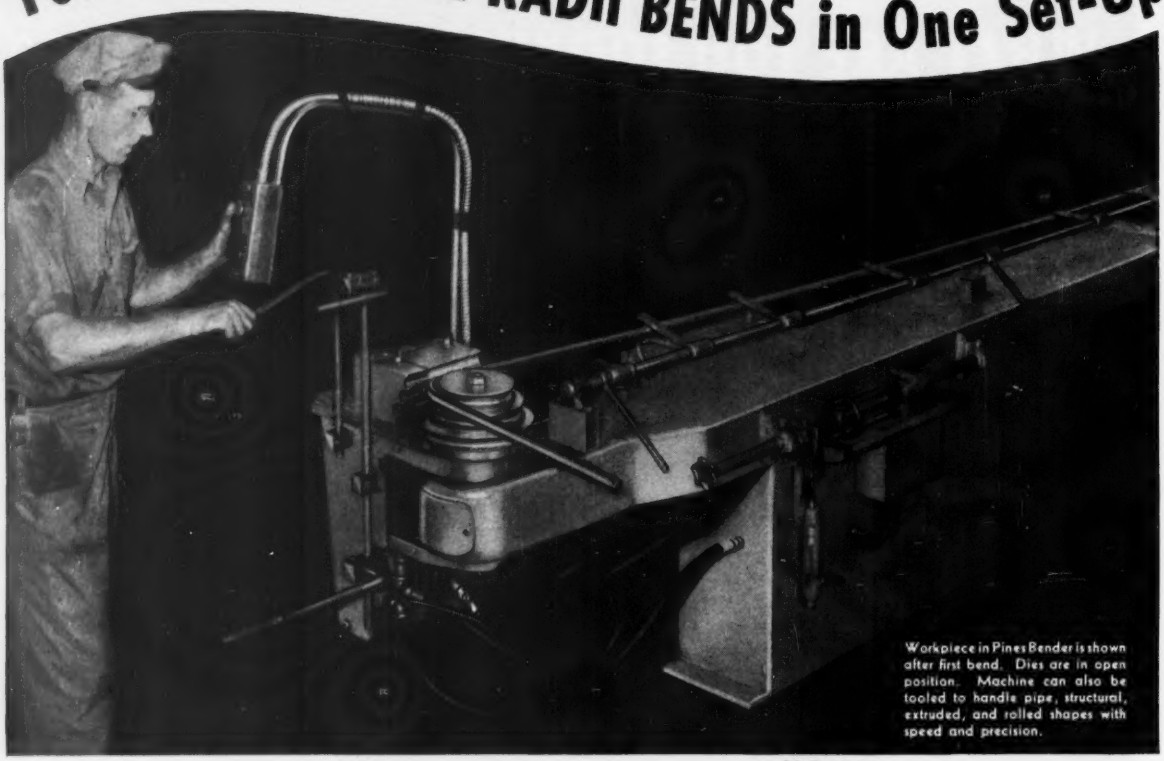
ANSONIA, CONN.—*Plants:* Ansonia & Derby, Conn., Buffalo, N.Y.

Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Detroit, Chicago, Memphis, Minneapolis, Portland (Oregon), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

Farrel-Birmingham®

FB-810

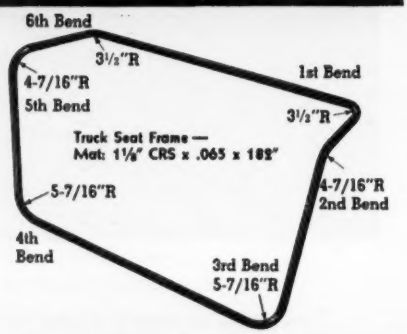
Forming MULTIPLE RADII BENDS in One Set-Up



Workpiece in Pines Bender is shown after first bend. Dies are in open position. Machine can also be tooled to handle pipe, structural, extruded, and rolled shapes with speed and precision.

HOW A PINES AUTOMATIC BENDER Speeds Production at Randall Company

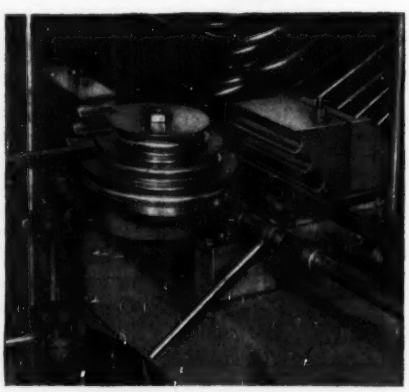
The Pines Automatic Bender set-up illustrated here is one employed by The Randall Co. of Wilmington, Ohio, to speed production of truck seat frames requiring six bends of three different radii. The machine and tooling, designed and built by Pines, forms the complete frames on one machine. Operations are performed in sequence with a triple die set-up. Tool changes are eliminated, and daily production maintained at an average rate of 240 bends per hour. Machine is push-button controlled and hydraulically operated — is adaptable to a wide range of production bending jobs, handles serpentine, coil, compound, and multiple bends without marking or distorting. Complete range of sizes for light or heavy work are available.



When you have a production bending problem, call on Pines Engineers for assistance. Chances are they can also help you save time and cut costs.

FREE DATA SHEETS

Write today for free copies of "Pines News" illustrating and describing bending and tooling techniques on actual jobs.



Close-up of pressure and clamping die in open position after completing fourth bend. For each radius operator simply positions stock in proper grooves of triple die. Planes of bends are determined by floor mounted gauges.

PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

BENDING • DEBURRING • CHAMFERING • THREADING MACHINERY

687 WALNUT • AURORA, ILLINOIS

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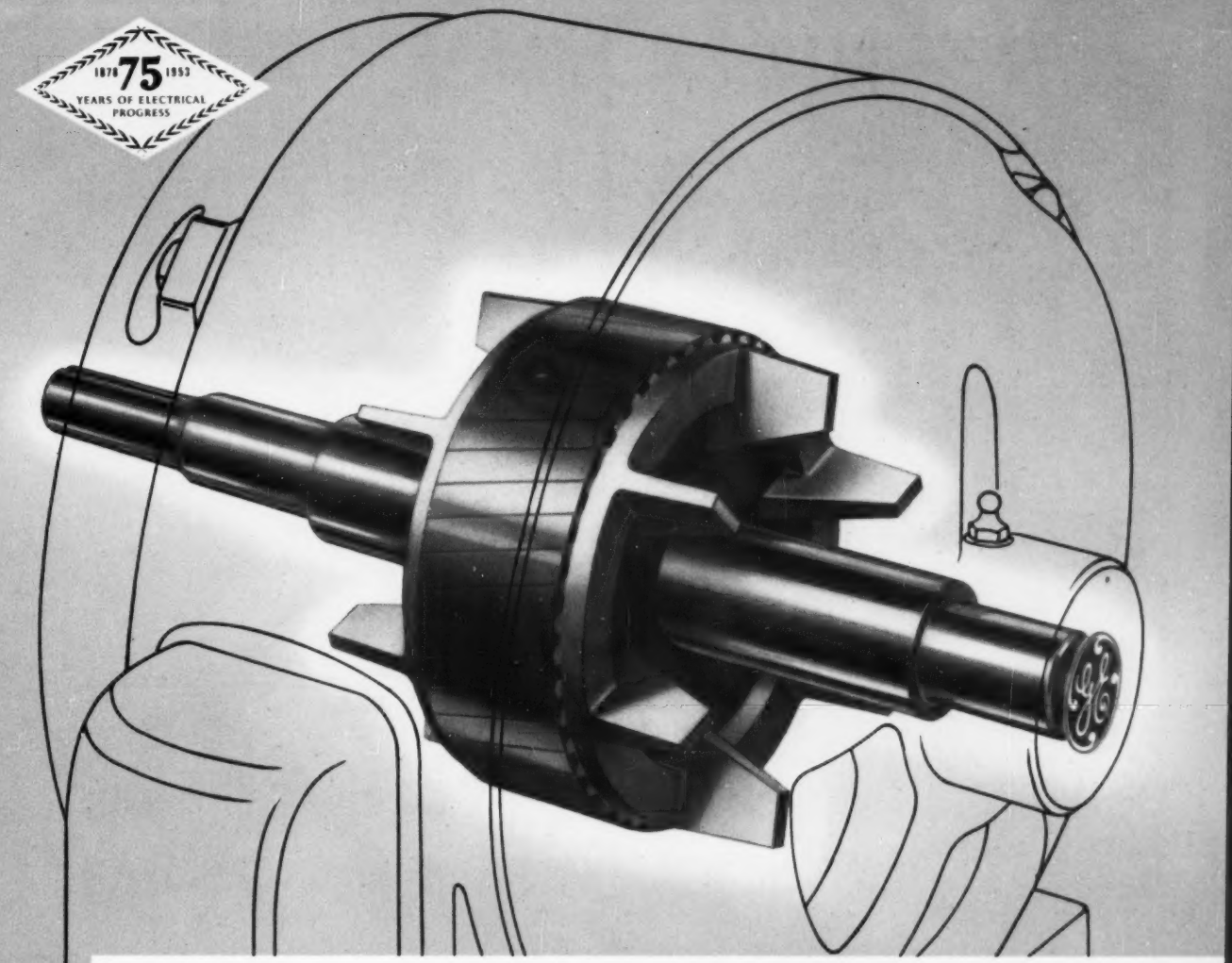
YEARS OF ELECTRICAL PROGRESS



Why rotors don't fail in G-E TRI CLAD motors

REG. U.S. PAT. OFF.

G-E pioneering and research developed and produced this one piece cast-aluminum rotor winding, which has virtually eliminated rotor failures in Tri-Clad motors.

Rotor is indestructible in service because the bars, end rings, and fans are a "one-piece" casting. No brazed joints, no fabricated fans to come apart.

Rotor inertia is reduced by the lightness of the aluminum, thus raising efficiency and allowing easier starting, stopping and reversing.

Rotor efficiency is higher, operating losses reduced, as the result of a special chemical treatment.

The motor runs cooler because the integrally cast fans dissipate heat faster.

Operation is smooth and quiet due to the dynamic balancing of the rotor which also reduces bearing wear and material fatigue.

Long rotor life is one more reason why G-E Tri-Clad motors last longer — give you more reliable service and greater operating economy.

Order Tri-Clad motors today from your nearby G-E representative. You'll find popular models in stock. General Electric Co., Schenectady 5, N. Y.

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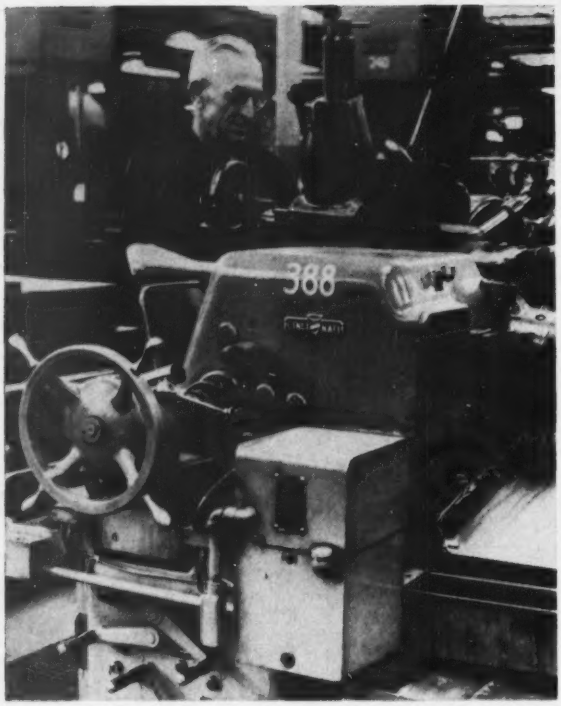
You can put your confidence in—

GENERAL ELECTRIC



LONGER MACHINE LIFE and more efficient service—because this unseen G-E process timer gives precise, dependable control.

AUTOMATIC PROCESS CONTROL permits operating an oil pump for a predetermined percentage of machine operating time.

G-E Process Timer Provides Automatic Machine Oiling, Boosts Operator Output, Increases Apparatus Life

One example of the precise control provided by this Telechron* powered timer is in the application shown above. Here the TSA-14 process timer controls a motor and a pump, which in turn supply oil to various parts of the machine. Because of automatic—rather than manually controlled—lubrication, the operator's output is measurably increased, machine life is prolonged, and shut-down time for repairs is reduced to a minimum.

MANY APPLICATIONS

"Stopwatch accuracy"—that's how the controlling accuracy of the TSA-14 process timer is described. This preset control provides exact on or off timing for machine operations. Applications for the TSA-14 range from pumping control to the accurate timing required by chemical processes.

FOR MORE INFORMATION

Write or call your nearest G-E Apparatus Sales Office, or Authorized Agent or Distributor. Ask for Bulletin GEC-525. General Electric Company, Schenectady 5, N.Y. 603-151

*Reg. Trade-mark of the General Electric Co.

You can put your confidence in—

GENERAL ELECTRIC

EASY INSTALLATION is yours with the TSA-14, which is equipped with pipe nipple for easy mounting and flexible leads with color code for simplified wiring. Write for your descriptive publication today!

THERE'S A DANLY STANDARD TO MEET YOUR DIEMAKING SPECIFICATIONS

In nearly every instance, Danly can meet your diemaking specifications with *standard* Danly Die Sets and *standard* Danly Diemakers' Supplies. Eliminate delay between design and production . . . you can be sure of prompt delivery from completely stocked Danly branch assembly plants located in major toolmaking centers.

More than 30 years' experience in supplying diemakers' needs has established Danly's reputation for design excellence and dependable accuracy. Diemakers everywhere *prefer* Danly!

Plan now for faster tooling *and* longer production runs at less cost . . . with Danly Die Sets and Danly Diemakers' Supplies.

Call Your Local Danly Branch Today!

*CHICAGO 50—2100 S. Laramie Ave.
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*GRAND RAPIDS 113 Michigan St., N.W.
INDIANAPOLIS 4—5 West 10th St.
*LONG ISLAND CITY—47-28 37th St.
*LOS ANGELES 54—Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2—111 E. Wisconsin Ave.
*PHILADELPHIA 40 511 W. Courtland St.
*ROCHESTER 6—33 Rutter St.

*Indicates complete stock

DANLY

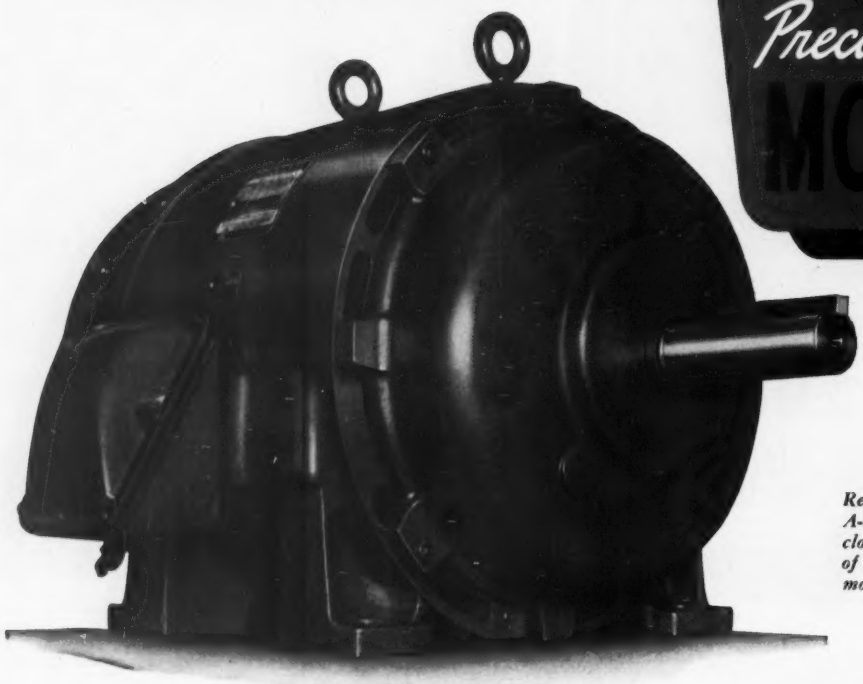
DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois

DIE SETS AND DIEMAKERS' SUPPLIES

FOR RUGGED SERVICE...

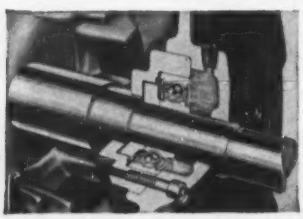
"All motors are NOT alike!"

RELIANCE
Precision-Built
MOTORS



Reliance Totally-enclosed Fan-cooled A-c. Motor. All other standard enclosures available, with wide choice of mechanical designs and special mountings. Ratings from 3/4 to 300 hp.

- ☆ Heavy shafts, bearing to bearing
- ☆ Indestructible pressure-cast rotors
- ☆ Shock-resistant frame and bearing-bracket construction



. . . AND THE BEST PRE-LUBRICATED BEARING DESIGN

The Reliance pre-lubricated bearing provides *four times more operating hours without re-lubrication* than any other bearing used in motors today. And—whatever your lubrication schedule—*you just can't grease'em wrong!* To get the complete "inside story" on motor bearings, write today for Bulletin B-2201. It contains hard facts on the advantages of the Reliance pre-lubricated bearing design, with cutaway view, cross-section diagram, comparison chart, and statements by bearing manufacturers. B-1458 J

RELIANCE ELECTRIC AND ENGINEERING CO.

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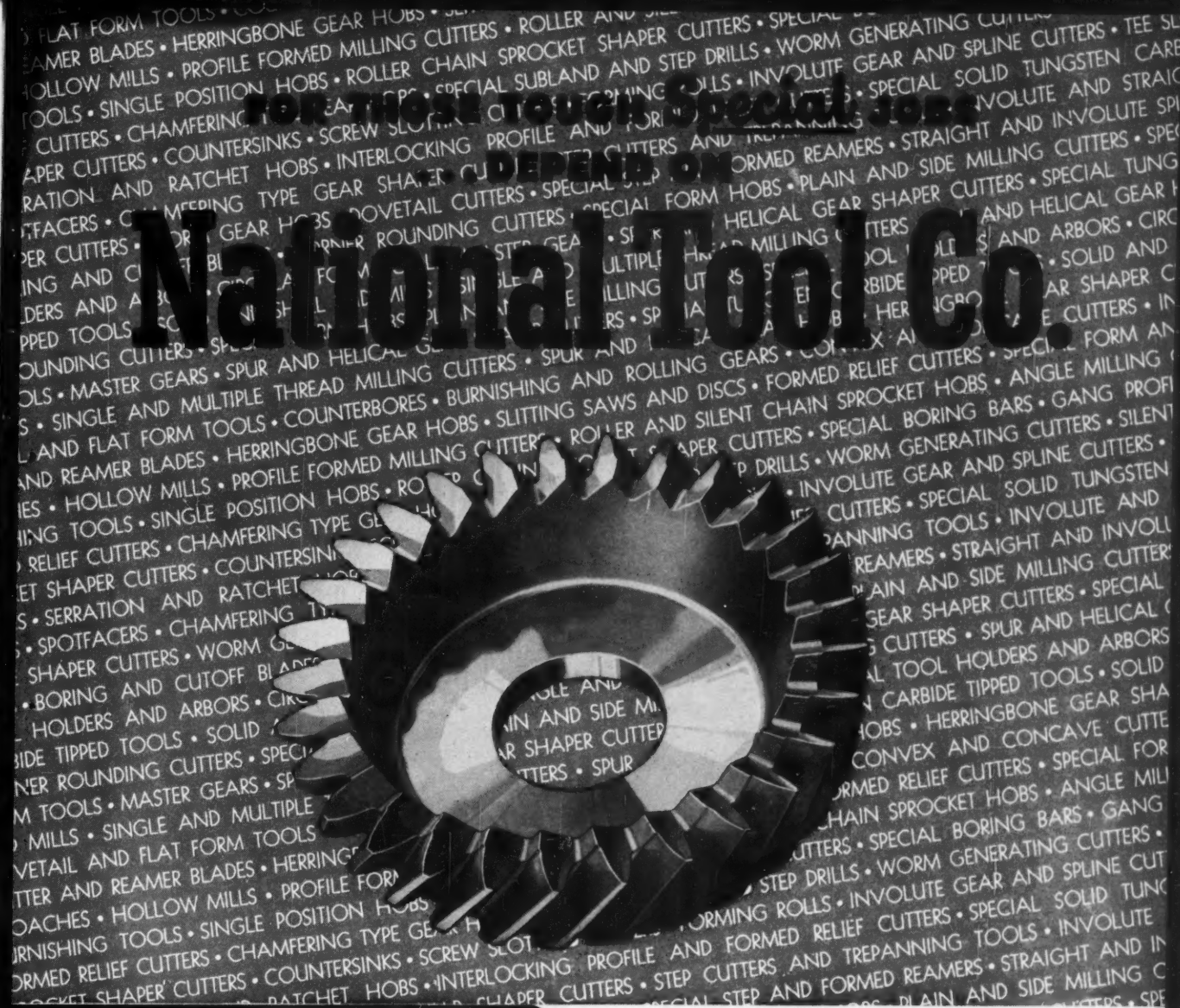


● Years of successful experience in *special* tooling and related production problems are yours for the asking. When the job requires *special* cutting tools call in your National Tool Co. representative. He is backed by more than 46 years experience in the engineering and manufacture of *special* cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

Since 1905 engineers and manufacturers of high-quality special cutting tools for the metal-working industry

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

You can make high quality welds, quickly and easily, in stainless, aluminum, cast iron, HASTELLOY and MULTIMET alloys—practically all commercial metals—at lower cost with the 300 amp. HELIARC HW-10 water-cooled torch.

You'll find that the improved water-cooling system assures cooler and more effective operation even when the torch is used continuously at the full rated capacity. The cooling water flows through the power cable and torch body down to the water jacket and gas cup. The return flow follows the same route in reverse. All exterior "plumbing" has been eliminated allowing more maneuverability and preventing leakage due to accidental damage. Water-cooling makes lightweight torch construction possible, and because the power cable is also water-cooled, it too, is lightweight and easy to handle.

The HW-10 was designed so that the water passages are accessible and easily cleaned.

Electrodes are easily adjusted on the HW-10. A quarter turn of the torch cap releases the electrode for adjustment or replacement. You need no wrenches or other tools. In addition, electrode stub loss is reduced by placing the water-cooled electrode holder much closer to the arc.

Are you getting the best possible results from your present welding apparatus? Developments in the inert gas welding field have been so great and have come so rapidly that torches over four or five years old are now obsolete. Be sure that you have the highest production at the lowest cost. Modernize with the 300 amp. HELIARC welding torch.

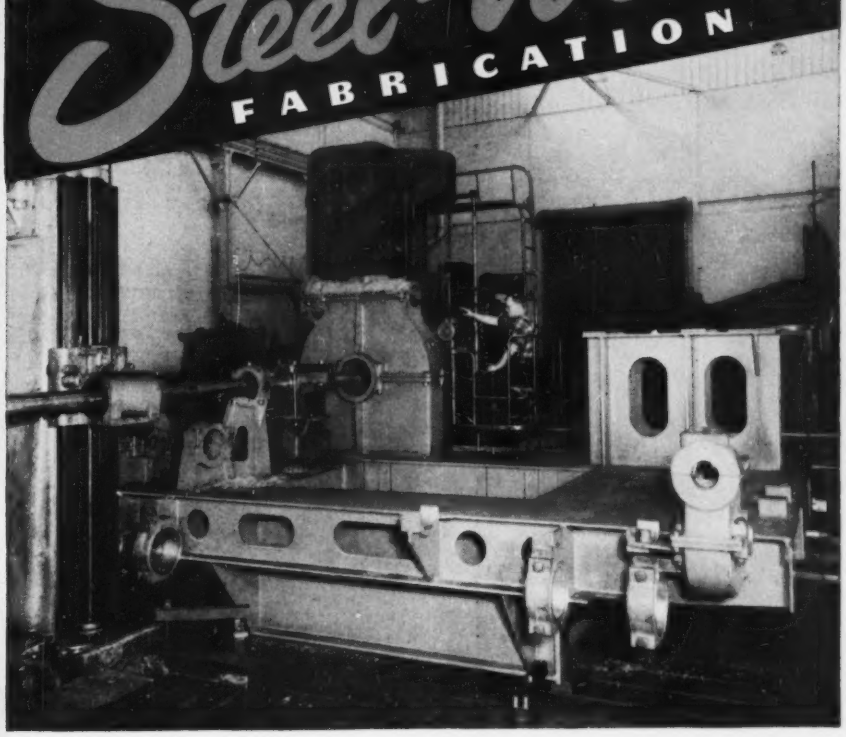
Your local LINDE representative would be happy to give you more detailed information on the HELIARC HW-10.

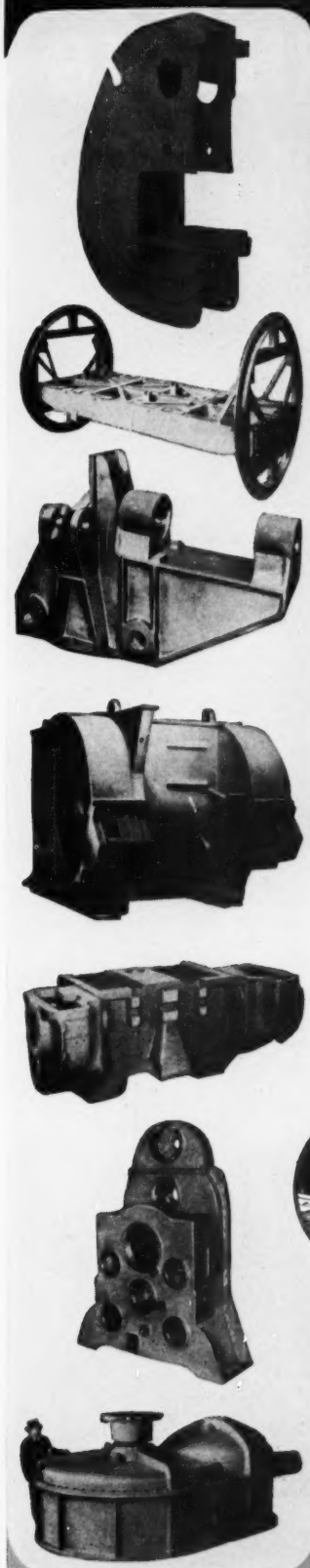
"Heliarc," "Hastelloy," "Linde," and "Multimet" are registered trade-marks of Union Carbide and Carbon Corporation.

Linde

LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
General Office: UCC New York 17, N.Y.
In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

Steel-Weld FABRICATION





Use WELDED STEEL for Greater Strength with Less Weight!

Above you see a Steel-Weld Fabricated trolley frame for a heavy crane. This and the units illustrated at the left are typical of thousands of welded steel parts and assemblies produced by Mahon for many industries throughout the country. Facilities are available within the Mahon plant to do the complete job from the drawing board to finished machining. If you have parts or assemblies that could be redesigned and produced to better advantage through Steel-Weld Fabrication, or, if you require a limited number of large, heavy pieces in which pattern costs are a consideration, you can turn to Mahon with complete confidence. You will find in the Mahon organization a unique source with complete, modern fabricating, machining and handling facilities to cope with any type of work regardless of size or weight . . . a source where skillful designing and advanced fabricating technique are supplemented by craftsmanship which assures a smoother, finer appearing job embodying every advantage of Steel-Weld Fabrication. See Mahon's Insert in Sweet's Product Design File, or write for further information.

THE R. C. MAHON COMPANY
DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON

CLEEREMAN DRILLING MACHINES

LOWEST Operating Costs!

Why?

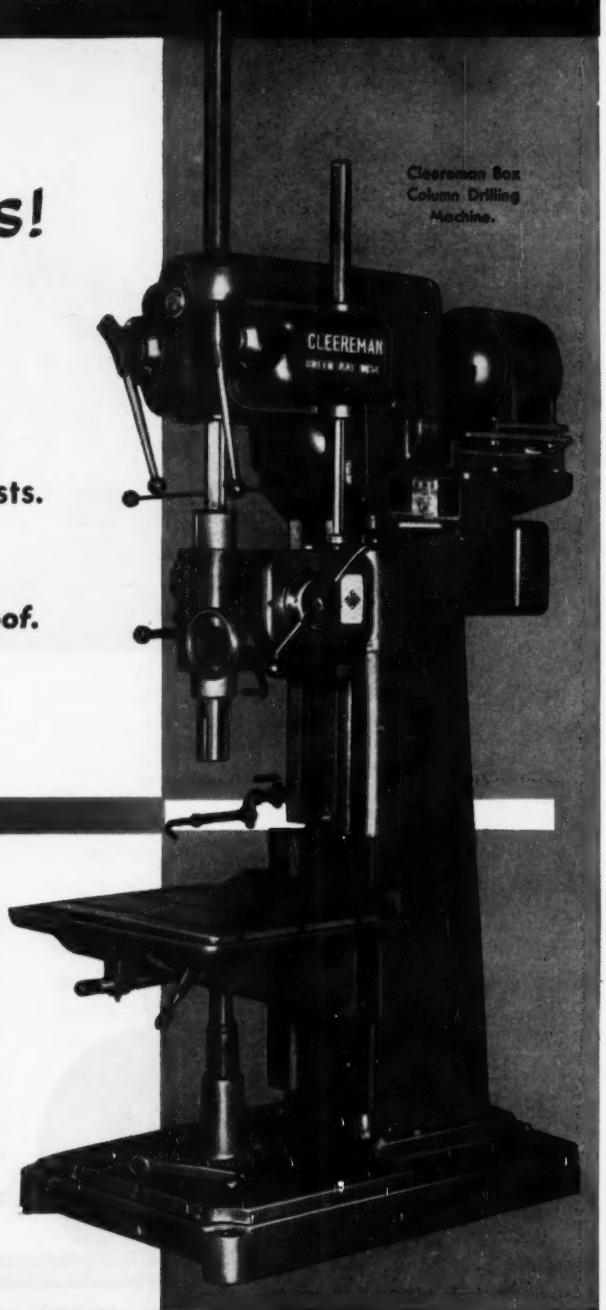
1—Eliminate Down Time.

2—More Power to Produce.

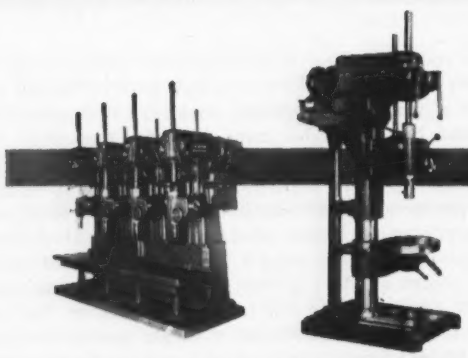
3—Lowest Maintenance Costs.

4—Less Operator Fatigue.

Go to any Cleereman user for proof.



Cleereman Box Column Drilling Machine.



Cleereman Multiple Drilling Machine.

Cleereman Round Column Drilling Machine.

Affiliated with..

CLEEREMAN MACHINE TOOL CO. Green Bay, Wisconsin

BUILDERS OF PRECISION JIG BORERS AND DRILLING MACHINES

Save time... slash costs... switch to Black & Decker POWER!

YOU don't have to be an engineering genius to sell yourself on Black & Decker Tools! Their performance hits you right between the eyes as they gobble up job after job . . . saving money, muscle and man hours. Their modern design sticks out in streamlining, light weight and perfect balance that mean easy handling. And their quality construction is proved by tools that put out and pay off for year after year after year!

That's why they've won their spurs with millions of men who take a long, hard look at *any* tool . . . production bosses, maintenance men. That's why we'd like *you* to put them to the test. Ask your friends about them. Ask your nearby Black & Decker Distributor for a demonstration. Write for our free, detailed catalog of over 100 time-saving, cost-cutting Portable Electric Tools to: THE BLACK & DECKER MFG. CO., 605 Pennsylvania Ave., Towson 4, Maryland.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker
PORTABLE ELECTRIC **TOOLS**

DRILLS . . . Models and speeds to fit any job in capacities from ¼" to 1¼" in steel, double in hardwood. Many attachments.

SANDERS . . . Drive abrasive discs, wire cup brushes, saucer grinding wheels, other attachments. Four models, 7" and 9" capacities.

BENCH GRINDERS . . . Three models, 6"-10" wheel diams., ¼ to 1 H. P., for sharpening, grinding, wire brushing, buffing.

PORTABLE GRINDERS . . . Bring the tool to heavy, bulky, hard-to-move work. Perfectly balanced. 3", 5" and 6" wheel diams.

HAMMERS . . . Drive star drills, bull points, chisels, etc., for work in masonry, other materials. Four models, rated by capacity in concrete for ¼" to 2" diam. holes.

PORTO-SHEARS* . . . For fast, accurate cutting of ferrous and non-ferrous sheet metal. Two models, 12 and 16 gage capacities in steel. Cut to small radius.

SCREW DRIVERS . . . Drive anything from delicate screws to large nuts and bolts. Many models, positive and adjustable clutches. 190° angle models for close-quarter work.

FACTORY SERVICE . . . A Black & Decker *extra!* Nationwide network of company-operated branches within 24 hours of *any* customer provides fast, accurate, reasonable service.

WRITE TODAY FOR 1953 BLACK & DECKER CATALOG. Gives you full details on over 100 Tools and hundreds of useful accessories. Fill out the coupon below or attach it to your letterhead.

*Trade Mark Reg. U. S. Pat. Off.

THE BLACK & DECKER MFG. CO.
605 Pennsylvania Ave., Towson 4, Maryland
Please send me your *free* 1953 catalog of over 100 Black & Decker Tools.

Name .....

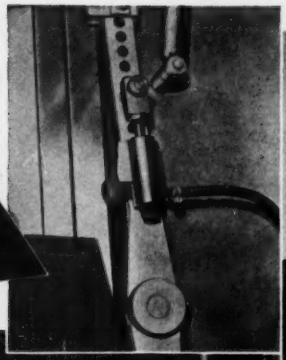
Company .....

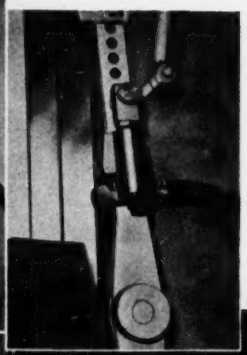
Address .....

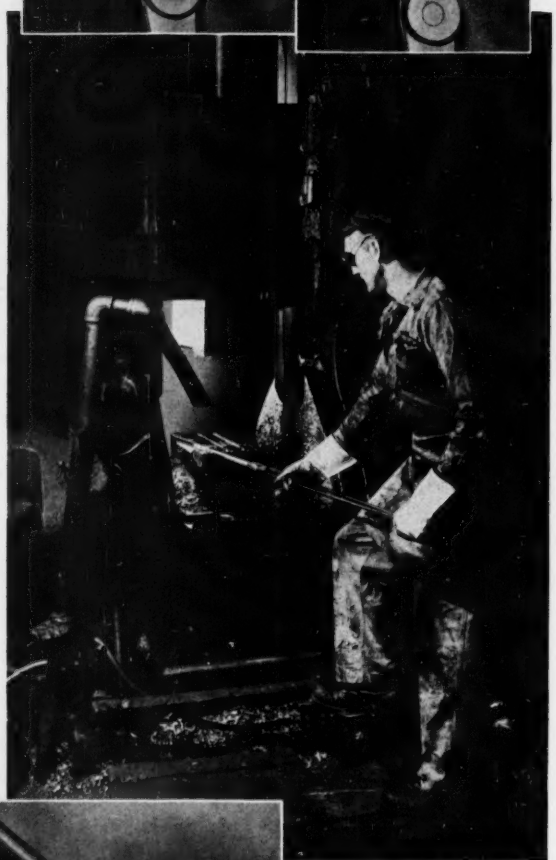
City ..... Zone ..... State .....

CECO-DROP SHORT STROKE CONTROL

"Makes the Hammer Talk!"







An installation of a Short Stroke Control on a 2500 lb. CHAMBERSBURG CECO-DROP HAMMER is shown, forging steel ankle joints for leg braces. Above are samples of the forging as it appears during various stages. The forging process begins with a series of 20 to 23 short, rapid blows (about 18" stroke) to draw the 2½" dia. stock. This is followed by two long blows (about 35" stroke) to roll it, three more long blows in the rough impression, and three more long blows to complete the forging. After the last blow the ram is stopped on the up-stroke at the "short blow" position for the next forging.

Short Stroke Control is but one of the many features of Chambersburg CECO-DROPS. These piston lift, gravity drop hammers are setting new standards in forge shop production. Lower operating costs, minimum down time, easy operation, wide range of operations, extra safety; all add up to "more forging per hour" the basis on which to judge the efficiency of a Drop Hammer. Write for Bulletin 11-L-0.

(Above right) Dog in full stroke Position. Wedge is lifted, Short Stroke Control is inoperative.

(Above left) Dog in Short Stroke Position. Wedge is down, holding dog in operating position.

(Lower left) Button on treadle when depressed by operator shortens the stroke. Release reverts to full stroke.

CHAMBERSBURG ENGINEERING COMPANY, CHAMBERSBURG, PA.

CHAMBERSBURG

THE HAMMER BUILDERS

ONE CUT
FROM THE SOLID
16 D. P. and Finer

- Gleason No. 2 Straight Bevel Generator
- Complete Precision Gears in one Operation
- Features Interlocking Multi-blade CONIFLEX® Cutters
- Easily Set-up for Job Lot Quantities
- Can Be Equipped with Automatic Loader
- Cuts CONIFLEX® Gears . . . Localized Tooth Bearing

GLEASON

GLEASON WORKS

BUILDERS OF BEVEL GEAR MACHINERY FOR OVER 85 YEARS

1000 UNIVERSITY AVE. · ROCHESTER 3, NEW YORK

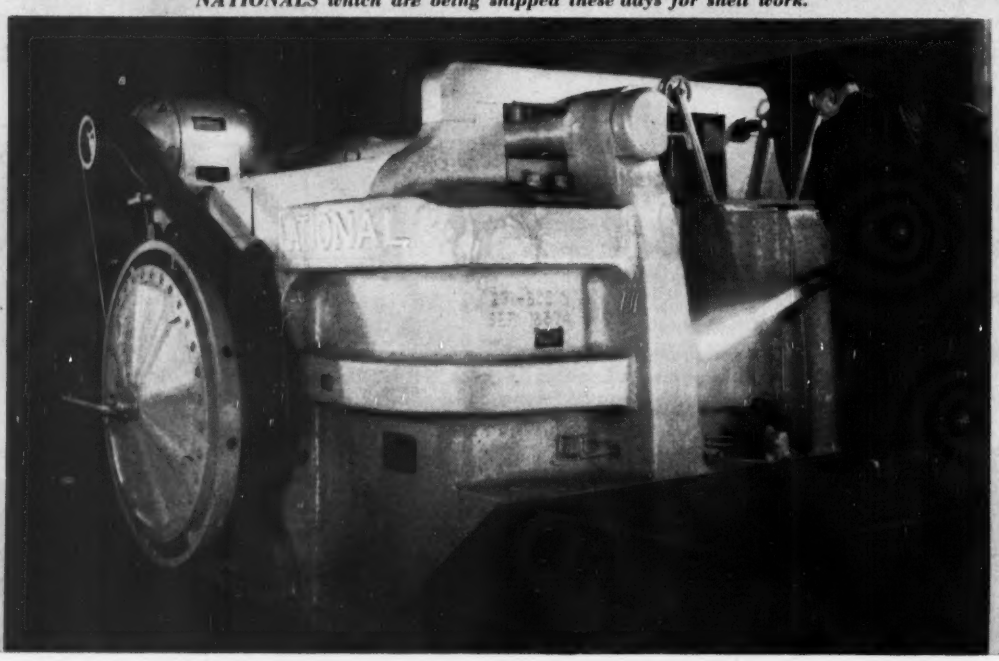
The SURE Way

YOU can get into production quickly on high explosive shells if you use the tried and proved (1) National-pioneered progressive piercing method and (2) National forging machines —*the right method and the right machine.*

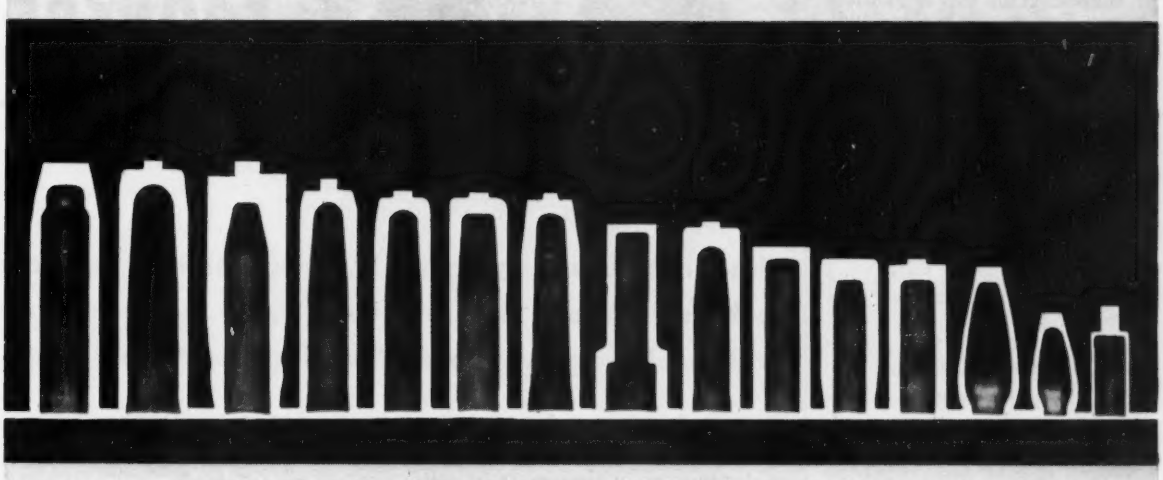
All operations are done on one machine, on one heat, by a single operator with no special skills. The result is a forging having a cavity finished to size and possessing excellent concentricity. Only minimum machining is required on the shell exterior.

A high production rate is attainable from the beginning, without multiple-stage operations involving excessive handling, annealing and coating, and without the need for scarce steels.

This 4" High Duty Forging Machine, tooled to forge the 75 mm. high explosive shell, is one of the many NATIONALS which are being shipped these days for shell work.



to Forge Shells!



Here are a few shell forgings produced on National High Duty Forging Machines in dies designed by National engineers.

Rugged, dependable National High Duty Forging Machines are designed for the exacting demands of shell work. The NATIONAL'S basic rigidity is vital for accurate die match. The exclusive diaphragm clutch insures round-the-clock trouble-free operation, year-in and year-out.

National engineers, with years of experience in all phases of shell forging, have tooled hundreds of High Duty Forging Machines for all types of deep-pierced ordnance jobs.

Whatever your problems, our forging engineering is at your disposal. Send us a print or sample of your jobs, or, better yet, pay us a visit, without obligation.

Shell forgers get assistance with their problems by working with National engineers.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO—SINCE 1874

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

Hartford Detroit Chicago

News About Created-Metals

Cuts Inventory 50% with Standard Tools

A leading appliance concern recently reported: . . . "As a result of suggesting to the responsible Process Engineering group standard tools which would perform the same service at an initial purchase saving, as well as a substantial saving in procurement time, our inventories of so-called special cutting tools have been reduced by more than 50%."

News about the new Carboloy MTI Plan indicates that it is designed to work similar benefits for cutting-tool users.

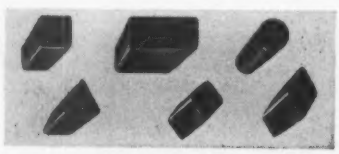
Details can be had by writing the Carboloy organization (address at right).

★ ★ ★

Complete Line of Insert Blanks

With the addition of two new diamond-shaped styles, the Carboloy line of carbide blanks for insert tools is now complete.

Available in 12 sizes, the styles



are square, rectangular, round, triangular, 55° diamond and 80° diamond. Blanks are available from Carboloy stocks or from Authorized Distributors.

★ ★ ★

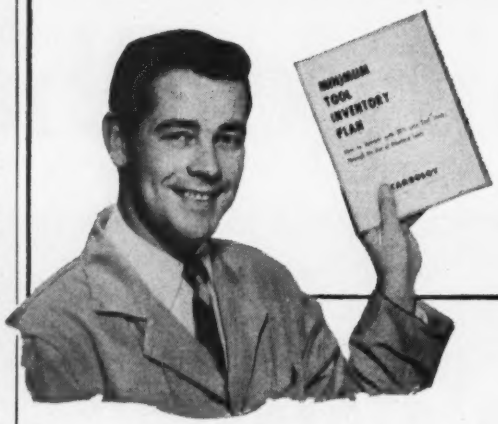
New, Free Magnet Idea Kit for Shops

A handy, new literature kit showing the how's and why's of permanent magnets is currently sparking shop men to real savings in time and money.

The magnets have proved very effective as sheet steel separators, magnetic stands, tool-holding devices, sweepers' "pickup" tools and tool retrievers, to name a few uses.

Kit can be obtained free from Carboloy Department of General Electric Company. (See address at right.)

YOUR CARBOLOY FIELD REPRESENTATIVE SAYS . . .



"This reduces

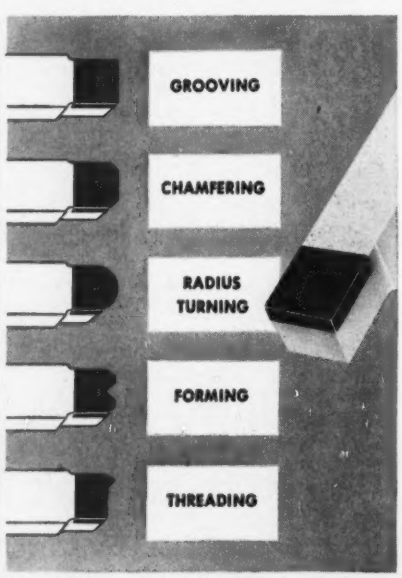
"It's an astoundingly simple, practical way for you to benefit from the low cost, wide adaptability and quick availability of Standard Carboloy Tools.

"Briefly, here's how the Minimum Tool Inventory Plan works: Instead of loading your shelves with special, made-to-print single-point carbide tools, you stock a lesser number of Carboloy 'Standards' . . . always available from distributors' stocks nearby. The MTI Plan shows you how to convert these Standards, *in minutes,* to handle about 80% of your special jobs.

"Your operating efficiency stays at par or improves. Your inventory goes down – about 30% or more. You cut out tooling delays, save on initial tool investment and tool cost. You streamline your inventory procedures, reduce tool waste . . . get many other benefits shop-wide.

"Send coupon for MTI Plan Kit."

1 ADAPTABLE for up to 80% of your single-point tool jobs



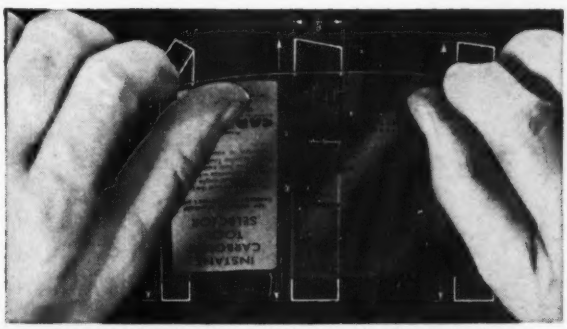
Above is a Style C Standard Carboloy Tool. It can be used "as is" for some jobs, or ground quickly to many special shapes. Five typical ways it can be adapted are shown.

There are only 11 styles of Standard Carboloy Tools . . . ready to be used "as is" for general turning, facing and boring . . . or quickly ground on regular carbide grinding equipment to fit those tricky special jobs. With Standards, you need *fewer* tools to do *more* jobs. Thus, you operate on lower inventories.

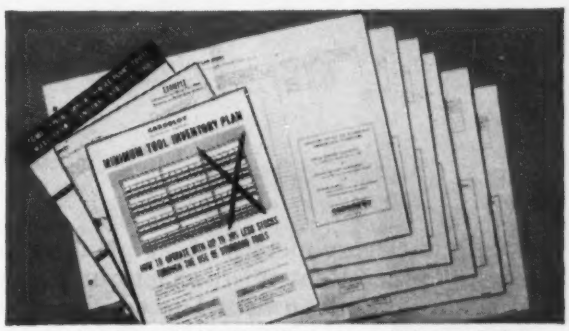
2 AVAILABLE always from nearby Carboloy distributors

You can get off-the-shelf delivery on Carboloy Standards in 98 cities from coast to coast. No waits. No production delays as with special, made-to-print carbide tools. Knowing you can get such speedy delivery of Carboloy Standards means you can cut your inventories still more.

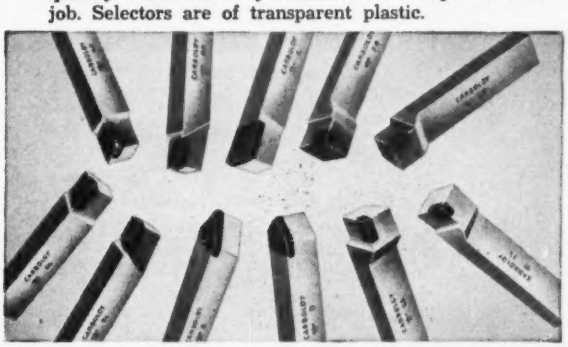
new Carboloy MTI Plan
your tool stocks up to 30%"



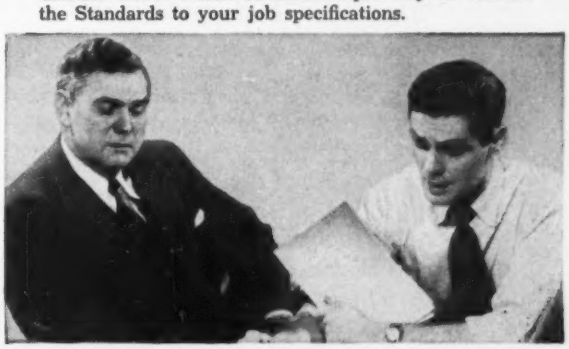
3 **Free MTI Plan Kit** includes two handy tool selectors. You place them over your special prints, find out quickly which Carboloy Standard best adapts to each job. Selectors are of transparent plastic.



4 **Kit also includes** Plan Sheets in which to tabulate your Standard Tool selections, and easy-to-follow Grinder Sheet which outlines simple way to convert the Standards to your job specifications.



5 **At once you'll see** how you can operate with up to 30% fewer tool stocks. Next step is to phone your nearby Carboloy Distributor for swift delivery on *only* the Standard Carboloy Tools you need.



6 **Should you have** the slightest difficulty getting the plan rolling, a Carboloy sales representative will call at your plant, help you smooth out the kinks. His expert services won't cost you a penny.

SEND COUPON TODAY—PINNED TO YOUR COMPANY LETTERHEAD—
FOR YOUR FREE MTI PLAN KIT

CARBOLOY TOOLS ARE STOCKED COAST TO COAST BY

AUTHORIZED CARBOLOY CEMENTED CARBIDE DISTRIBUTORS

Look under "Tools" in the Yellow Pages of your local telephone book or in Thomas' Register for your nearby Carboloy Distributor. He has complete local stocks and services. Ask him about the MTI Plan.

"Carboloy" is the registered trademark for the products of the Carboloy Department of General Electric Company.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11147 E. 8 Mile Ave., Detroit 32, Michigan

☐ Please rush me, at no cost or obligation, your MTI Plan Kit.
☐ Have your sales representative call, without obligation.

Name_____ Position _____

Company_____

Address_____

City_____ Zone____ State_____

NO GETTING AROUND IT!

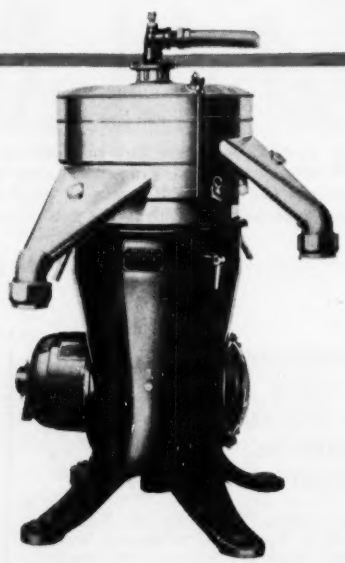
In All These 18 Applications De Laval Purification Pays Off!

Almost every metalworking plant has one or more operations where an adequate supply of clean, dry oil is a virtual necessity. 18 such applications are suggested in the panel and in every case a De Laval Oil Purifier provides the quickest, low-cost method of keeping these oils ***clean*** and ***dry***.

Clean oil is the prime requisite in most cases. Because of the greater intensity of centrifugal force, De Laval machines are more thorough than any other means. They remove every bit of dirt, abrasive or metallic particles. Thus, cutting oil can be used safely over and over again, with increased tool life and possibly less dermatitis among the men. Dies last longer when drawing oil is centrifuged; tests are more reliable when testing oil is purified.

Dryness can be a most vital consideration, as in the case of slushing compound purification. Here, too, De Lavals do the best work, quickest and most thoroughly. Water removed from the oil is continuously discharged—cannot possibly lead to recontamination.

MOTOR BLOCK TEST OIL
BALER OIL • BORING OIL
BRIQUETTING OIL • CABLE OIL
CUTTING OIL • DRAWING OIL
GRINDING COOLANT
ENGINE OIL • HONING OIL
HYDRAULIC OIL • RECOIL OIL
LUBRICATING OIL
SHOCK ABSORBER OIL
QUENCHING OIL
SLUSHING OIL
TRANSMISSION OIL
WASHING OIL



DE LAVAL

PURIFIERS AND CLARIFIERS FOR FACTORY OILS

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

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ILLINITE®
STANDARD CUTTING TOOLS
Stocked by Leading
Industrial Distributors
ILLINOIS TOOL WORKS.
ILLINITE
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TOOL WORKS
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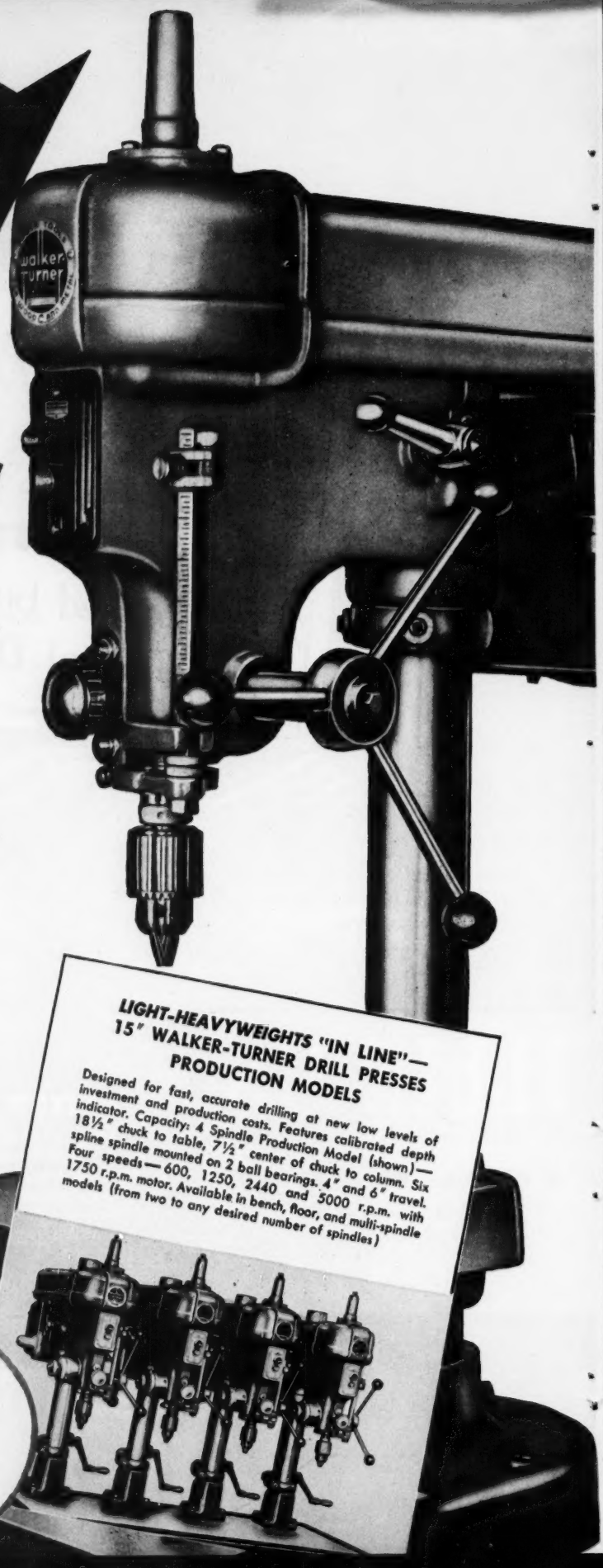
BETTER TOOLS . . . FASTER!
Ask your distributor for ILLINITE Standard Cutting Tools. End mills, saws, milling cutters, hobs, shaper cutters and tool bits all feature the design advantages, precision and metallurgical superiority that have made Illinois Tool Works engineered cutting tools so widely recognized. They're quickly available from stock to meet your production requirements.
SEND FOR THIS
FREE CATALOG TODAY!
Complete with dimensional and ordering information—organized for tool buying convenience. Write for your copy now!

Design with a $ sign—

(for savings in initial cost)



the new WALKER-TURNER

LIGHT-HEAVYWEIGHTS

Drill Presses

This is an entirely new *class* of machines Walker-Turner has engineered. *Light-heavyweights.* For jobs where neither the capacity nor the expense of a large radial drill is warranted. Yet where the "hobby power tool" would be inadequate. In shipping and packing rooms, for example . . . in pattern and maintenance shops.

The new Walker-Turner Light-Heavyweight line gives industry the capacity for short-run production work, without the necessity of heavy investment. It's design with a dollar sign, representing money saved. Walker-Turner makes 15″ and 20″ Drill Presses (in Bench, Floor, and Production models), as well as Radial Drills. Send for complete information. Simply write name and address in margin below.

WALKER-TURNER
walker-turner DIVISION
KEARNEY AND TRECKER CORPORATION
PLAINFIELD N. J.

DRILL PRESSES — Hand and Power Feed • RADIAL DRILLS • Wood and Metal Cutting BAND SAWS • TILTING ARBOR SAWS • RADIAL SAWS JIG SAWS • LATHES • SPINDLE SHAPERS • JOINTERS • BELT and DISC SURFACERS • FLEXIBLE SHAFT MACHINES

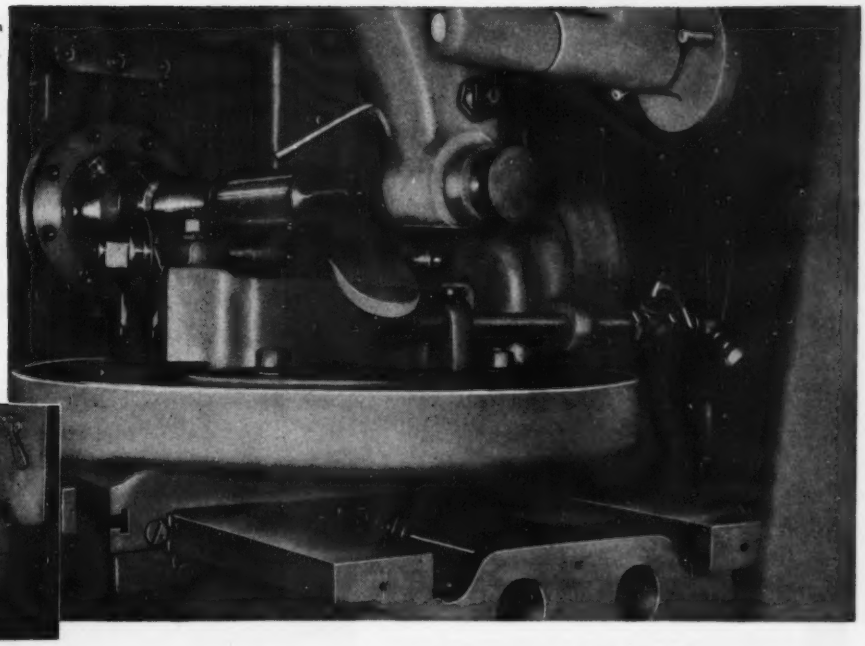
SOLD ONLY THROUGH
***TRAINED* INDUSTRIAL DISTRIBUTORS**

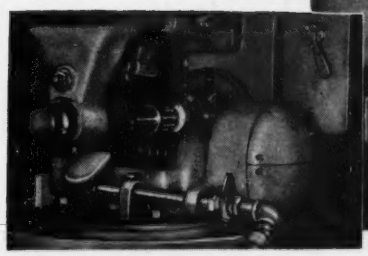
LIGHT-HEAVYWEIGHTS "IN LINE"—
15″ WALKER-TURNER DRILL PRESSES
PRODUCTION MODELS

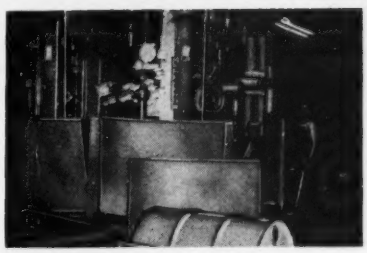
Designed for fast, accurate drilling at new low levels of investment and production costs. Features calibrated depth indicator. Capacity: 4 Spindle Production Model (shown)— 18½″ chuck to table, 7½″ center of chuck to column. Six spline spindle mounted on 2 ball bearings. 4″ and 6″ travel. Four speeds — 600, 1250, 2440 and 5000 r.p.m. with 1750 r.p.m. motor. Available in bench, floor, and multi-spindle models (from two to any desired number of spindles)

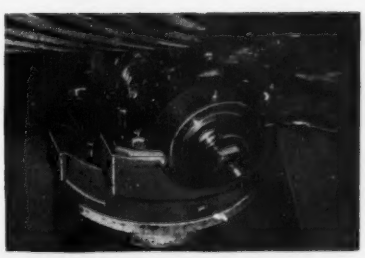
Use this space

to write for full details and specifications.
Walker-Turner Division, Kearney & Trecker Corp.
Dept. M-6, Plainfield, N. J.
(Please write your name and address in margin of page)









"ON-THE-JOB" CUTTING OIL TESTS BY CITIES SERVICE ENGINEERS!

at Timken-Detroit Axle Company

TOOL WEAR REDUCED 25%... MANUFACTURING COSTS ALSO CUT!

In an effort to reduce tool wear and cut manufacturing costs, the Wisconsin Division of Timken-Detroit Axle Company at Oshkosh called in Cities Service Engineers to make "on-the-job" tests.

Cities Service Lubrication Engineers made an on-the-spot study of the Timken-Detroit operation. This "on-the-job" evaluation by skilled Cities Service Engineers, long practiced in solving like problems, resulted in a recommendation for the use of a Chillo Cutting Oil that actually reduced tool wear 25% with proportionate savings in manufacturing costs!

WHAT ARE YOUR PROBLEMS? Why not take advantage of free, "on-the-job" testing? Call for our lubrication engineers at the office nearest you, or write Cities Service Oil Company, Dept. F12, Sixty Wall Tower, New York City 5, New York.

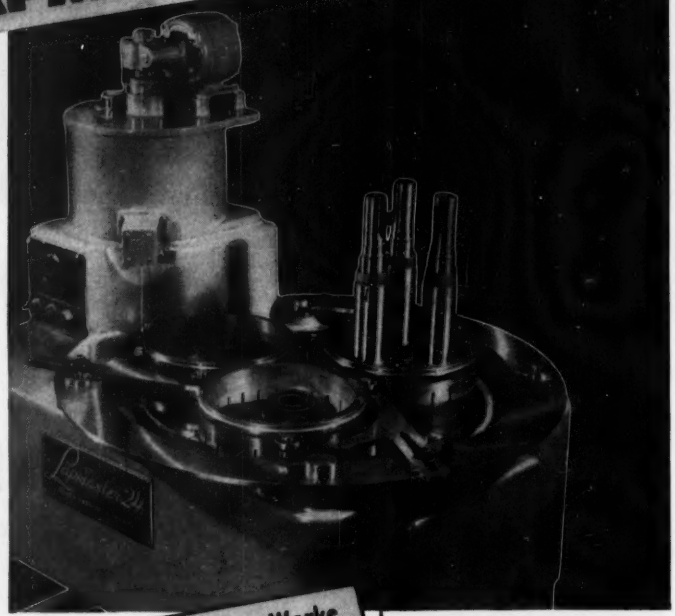
CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

WHY YOU GET

Precision Flatness, Finish and Parallelity in Production Quantities . . .

WITH A LAPMASTER

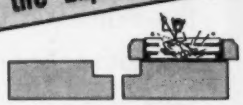


Here is the machine to do the job if you want precision flatness in production quantities at an economical rate. Lapmaster machines readily lap to the extreme close tolerance of one light band (0000116") or less. In addition, they produce an extremely fine finish to as low as 1 RMS.

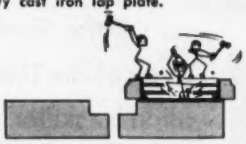
Check these features and investigate the possibilities for the Lapmaster in your plant.

1. Operator requires no previous lapping experience.
2. Automatic timer provides controlled lapping cycle for production efficiency and allows time for pre-loading workholders.
3. Simplicity of design allows ease of loading and unloading.
4. Loose abrasive distributed evenly over lapping area insures uniform results.
5. Serrated lap plate collects and disposes of spent compound and removed stock.
6. Precision laps identical parts or parts of various shapes, heights and materials in one cycle.
7. Self-conditioning lap plate eliminates down time for truing or replacement.

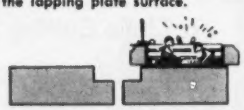
How the Lapmaster Works



The work being lapped causes wear on heavy cast iron lap plate.



As the work is wearing the lap, the conditioning rings are continually conditioning the lapping plate surface.



Since the wear action of the conditioning rings is greater than the wear caused by the work being lapped, the flatness of the lap plate is automatically maintained.

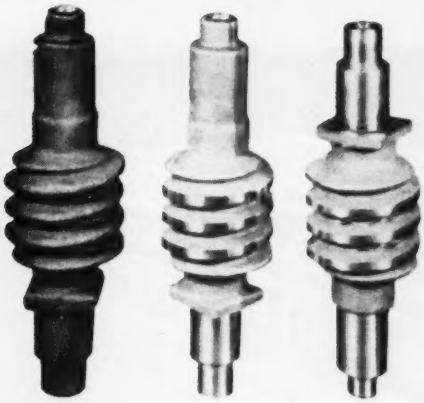
FREE DATA

Learn more about the possibilities of production lapping and the interesting subject of measuring flatness. The illustrated fact-filled booklets are yours for the asking. Write today.

Crane Packing Company, Dept. M-6, 1833 Cuyler Avenue, Chicago 13, Illinois

JOHN CRANE

CRANE PACKING COMPANY



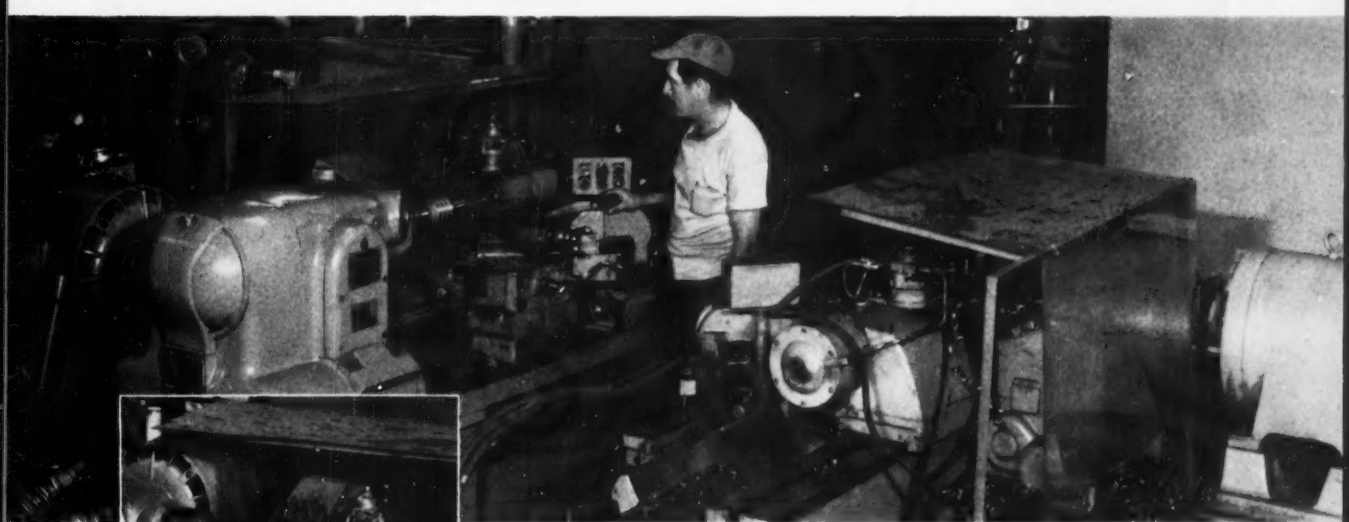
THIS EARLY BIRD GETS THREE TIMES THE WORMS!

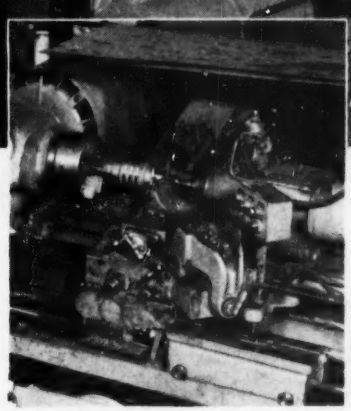
That's the Mona-Matic for you!

"THREE TIMES THE OUTPUT!", says Gar Wood Industries, Inc., of their new Mona-Matic installation. Output has increased, on turning these worm shafts, from 2 pieces formerly put on the floor every 14 minutes, 45 seconds to 2 pieces every 4 minutes, 9 seconds—one man operating two machines in each case. That's more than a 255% production increase for the Mona-Matics!

There's a great performance story here, too. Only a machine built like the Mona-Matic can deliver satisfactory finish and good tool life while maintaining required limits on the intermittent cut over the forged worm threads. The 2-speed motor on Machine #1 easily accommodates the turning of diameters as varied as those of worm threads and shaft end. Excessive stock removal from small end diameter is accomplished by dual template control on Machine #2. With two tools on rear slide of each machine, one faces the end of the shaft while one rough faces a shoulder and forms an undercut.

Here's a machine that can boost output and cut costs on long runs and short ones. Why not find out—right now—what it can do for you? Write for Booklet 1805 containing full information, data, job reports. It's new! . . . *The Monarch Machine Tool Company, Sidney, Ohio.*





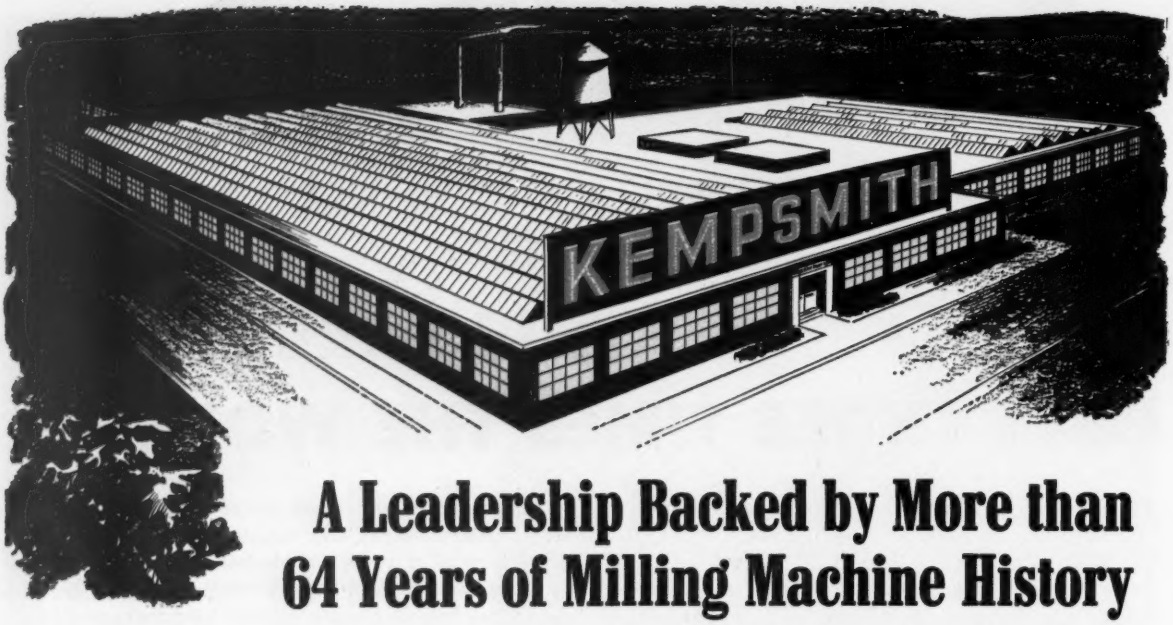
Part—Worm Shaft. **Material**—SAE 8640 forging. **Operation**—turn complete for grind using carbide tools. Limits ± .001". **Comment**—with one operator for two machines in each case, output has soared from 2 pieces every 14 minutes, 45 seconds to 2 pieces every 4 minutes, 9 seconds—a 72% reduction in machining!

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A GOOD TURN FASTER . . . TURN TO MONARCH



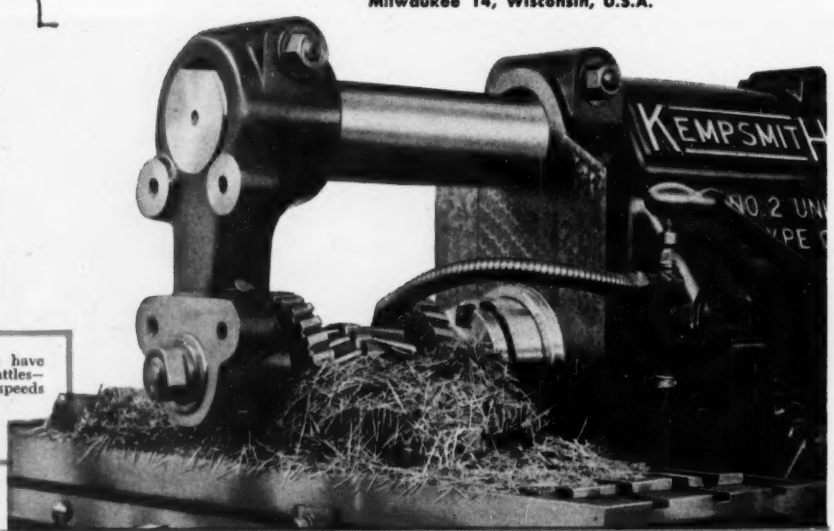
A Leadership Backed by More than 64 Years of Milling Machine History

Back in 1888, Kempsmith Engineers developed and produced the first Kempsmith Miller — a machine that was destined to achieve world-wide fame. The successful performance of this early model encouraged important engineering improvements and refinements resulting in much greater speed and precision in milling operations. Today, Kempsmith continues as a leader in the industry. The ruggedness, precision and ability to take heavy cuts smoothly make Kempsmith Milling Machines ideal for production, toolroom or general purpose milling. If you have a milling problem, consult Kempsmith. Our engineers will gladly give you the benefit of their broad experience in this specialized field.

THE KEMPSMITH MACHINE CO.

Milwaukee 14, Wisconsin, U.S.A.

Kempsmith Type "G" Plain Miller. All geared for positive power and smooth cutting, free from chatter. Note rugged, streamlined appearance. All controls are grouped within easy reach of the operator. Available in No. 1, 2 and 3 sizes, plain and universal models.



Let the chips fly— Kempsmith Millers have what it takes for rough production battles—built-in ruggedness, increased range of speeds and feeds, greater power. Every machine is precision-built, the product of 64 years of milling machine experience.

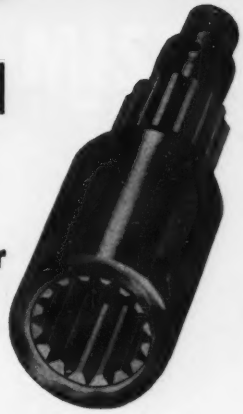
KEMPSMITH

• Precision Built Milling Machines Since 1888 •

A-7270-1PC

PRODUCTION JUMPED

from 12 pieces per hour to 90 pieces per hour on this part



when Perkins Machine and Gear Co. switched to SUNNEN® HONING

PROBLEM: To step up production of a splined bore, which required both correction of heat-treat distortion and final sizing.
MATERIAL: 4130 Steel
HOLE DIAMETER: .470″
HOLE LENGTH: 1.0″
HARDNESS: Rockwell "C" 55
STOCK REMOVAL: .001″ to .002″
FINISH: 32 RMS (approx.)
TOLERANCE: +.001″, −.000″

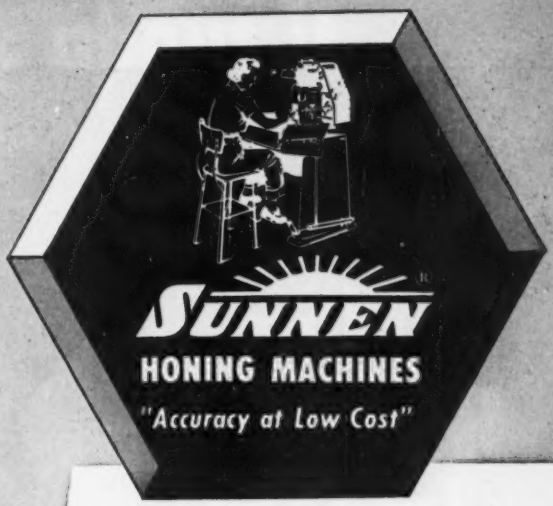
SOLUTION: Sunnen Model MBH-1290D Honing Machine with a Y12 keyway type honing unit and honing stone, using mineral honing oil. Semi-skilled labor is used.

RESULTS: 90 parts per hour including gaging time—an increase of 650% by switching to Sunnen Honing (previous method was to hand grind and polish). Tolerances for straightness and roundness are easily held; surface finish is quite satisfactory. This shop finds Sunnen Honing the right answer for many jobs that require sizing and finishing of internal diameters.

TYPICAL HONED PARTS

Cast iron hydraulic cylinder | Bronze motor bearing | Steel worm gear

SUNNEN PRODUCTS COMPANY
7988 Manchester Avenue, St. Louis 17, Missouri
Canadian Factory: Chatham, Ontario



In plant after plant Sunnen Honing Machines have been the solution to production problems that could not be handled by drilling, reaming, boring, lapping, or grinding.

You'll find them economical for job lots as well as long production runs . . . for de-burring as well as micro-fitting . . . for producing holes to engineering specifications as well as for eliminating manufacturing bottlenecks.

These machines generate geometrically perfect holes with fast stock removal . . . produce a guaranteed accuracy of .0001″ or better and surface finish to 2 micro-inches RMS . . . have a diameter range of ⅛″ to 2⅜″ . . . require no jigs or fixtures . . . are used in thousands of plants in production, tool room, maintenance, salvage. Average installation costs less than $1,000.

Sunnen Honing Machines may be *your* answer, too. Investigate now.

Mail the Coupon NOW for this Free Booklet

734

Sunnen Products Co.
~~7988~~ Manchester Ave., St. Louis 17, Missouri

☐ Send Free Booklet on Sunnen Honing

☐ Have A Field Engineer Call, no obligation

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Company.....

Address.....

City..... Zone..... State.....

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More Tools Per Man for More Profit

Even when labor was cheap and tools were costly, it was the best tooled shops that prospered. Now, with wages higher and the work days shorter, it becomes imperative that every worker be supplied with every tool that will increase his hourly production.

See that each lathe, planer and shaper operator has the correct ARMSTRONG TOOL HOLDERS for each operation he performs. Equip each machine with its full complement of ARMSTRONG Setting-up Tools. Use better balanced, handier ARMSTRONG WRENCHES on machines and assembly lines. Specify ARMSTRONG Drop Forged "C" Clamps and Lathe Dogs . . . Today, only quality tools can be truly economical.

Write for the ARMSTRONG Catalog. It has page after page of production-increasing, cost-cutting tools.

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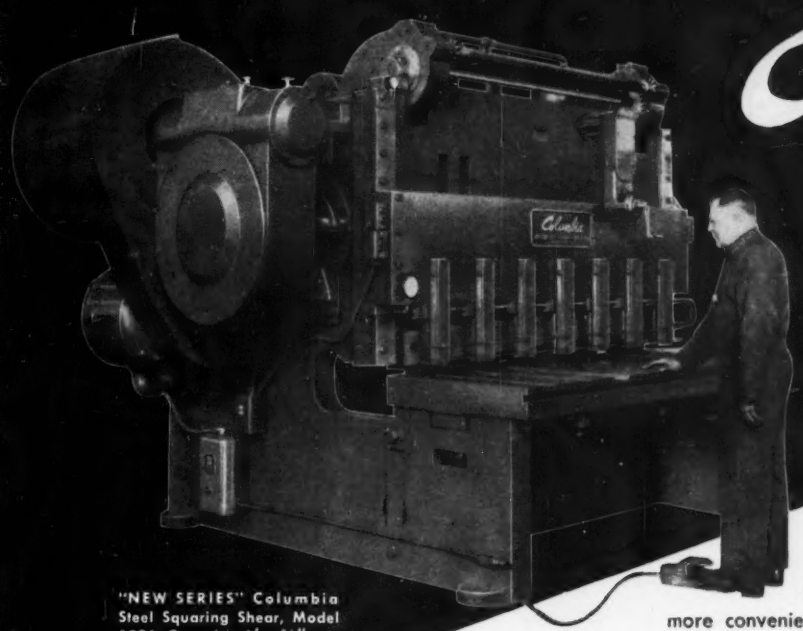
5315

MAKE NO MISTAKE about it

Columbia builds BETTER shears!



"NEW SERIES" Columbia Steel Squaring Shear, Model 1206. Capacity: 6′ x ¾".

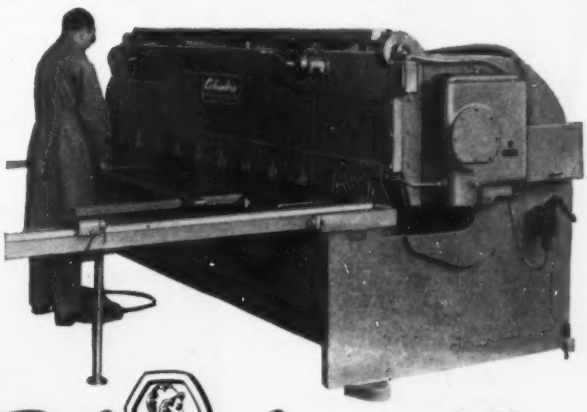
"NEW SERIES" Columbia SHEARS are more convenient in operation, more accurate and safer; incorporate more stamina, have a greater production potential. Consider that fact; and its implied benefits of longer tool life, easier maintenance, fewer repairs, more production, less scrap, fewer accidents!

AS A QUICK EXAMPLE of Columbia's better design take a look at the Columbia exclusive air clutch.

- ★ It reduces gear wear by as much as 75% through elimination of gear movement except in actual cutting cycle.
- ★ Application of power is soft. Shocks are not transmitted.
- ★ Inherent clutch slippage at overload point acts as automatic cut-off.

AND THE DESIGN IS RICH with parallel advantages. Such as the exclusive hydraulic holddown finger connections which contribute so much to the ease of holddown system maintenance; the special slitting provision which extends the capacity of the bed; the blade clearance setting gage, which makes blade clearance setting an "operator function."

Other capacities from 6′ x ⅜" to 6′ x 1¼", 12′ x 1", 14′ x ¾", or 20′ x ⅜" in mild steel.



DON'T FOLLOW BLIND PRECEDENT in the selection of your new shear. Don't risk the purchase of anything less than a modern Columbia tool. For the price is standard and delivery is often better.

FULL PARTICULARS WILL COST YOU only a minute of your time and the few cents required to mail your request. Don't delay! Even though your purchase of a shear may be a year or more away! Get the information now, and have it at hand when the need becomes urgent.

ASK FOR OUR FREE SHEAR CATALOG NO. 5315.
Address Columbia Machinery and Engineering Corporation, Hamilton 1, Ohio.

new series

Columbia STEEL SQUARING SHEARS and POWER PRESS BRAKES

First to offer...

carbide bar stock cut to length

Just as you purchase steel bars, strips or rods in standardized sizes or cut lengths, you can purchase **Talide Bar Stock.** You can buy this super hard metal cut to any length and finish grind in your own shop or purchase the required finished sizes direct from us. Cut lengths are available from stock at these warehouses:

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Chicago, Ill. ..... **601 N. Milwaukee Ave.**

Metal Carbides stocks 1325 different sizes of standard solid Talide Metal in these forms: Bars, Strips, Rods, Tubes, Bushings, Rings, Flats, Tips, Discs and special shapes . . . all carried in stock for immediate shipment. Special shapes can be furnished up to 25" O.D. in any length, and up to 1,000 lbs. per piece by weight.

You can purchase Bars from 1/16" square to 1/4" x 3/4" rectangular; Tubes 1/16" to 3/8" O.D.; Rods 1/16" to 1/2" dia. . . . IN ANY LENGTH. For complete information on **Talide Bar Stock,** ask for a copy of **Catalog 52-G. Metal Carbides Corporation,** Youngstown 7, Ohio.

Only Metal Carbides produces both Sintered and Hot Pressed Carbides

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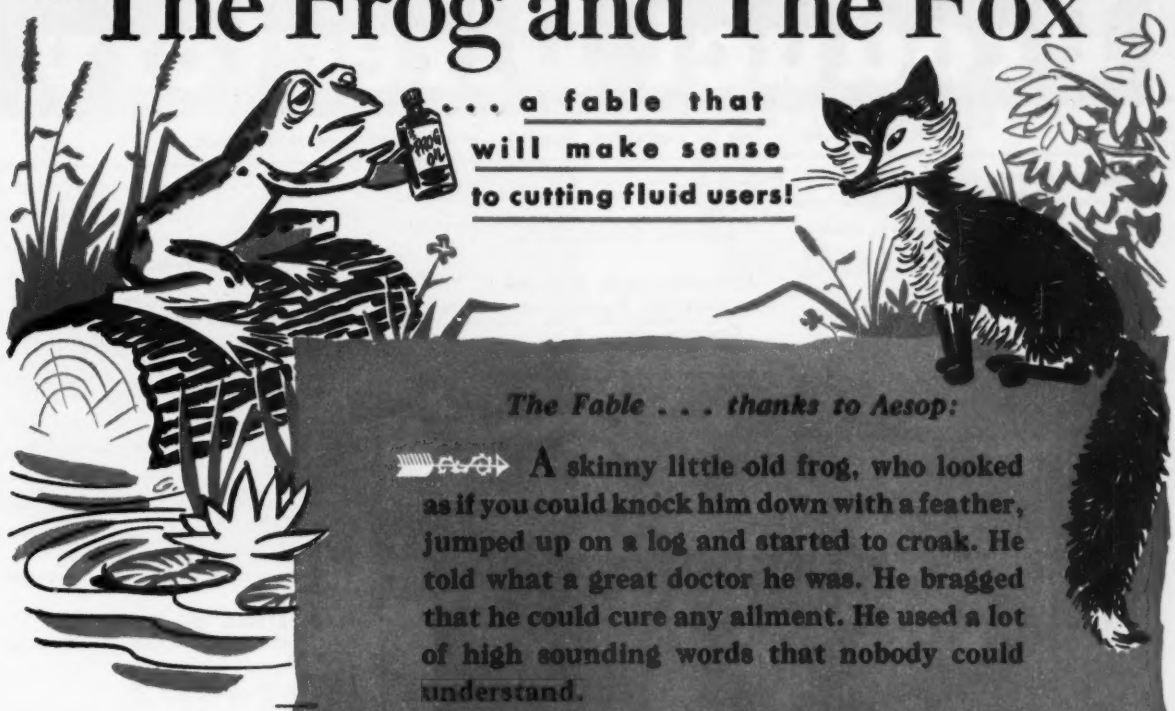
TUNGSTEN ALLOY HEAVY-METAL
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

"The Frog and The Fox"

. . . a fable that will make sense to cutting fluid users!



The Fable . . . thanks to Aesop:

A skinny little old frog, who looked as if you could knock him down with a feather, jumped up on a log and started to croak. He told what a great doctor he was. He bragged that he could cure any ailment. He used a lot of high sounding words that nobody could understand.

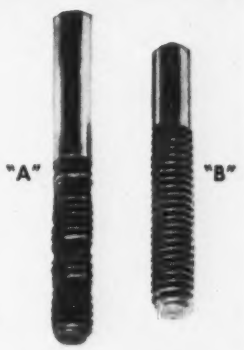
Finally, the Fox, who was pretty sly himself, said, "Frog, you pale, liver-spotted little weakling, you can't even cure yourself. Just saying you are a great doctor doesn't make it so!"

The Sense the Fable Makes:

You are often told that there are miracle-working cutting fluids that will cure all your problems in machining everything from brass to stainless. They often turn out to be like the phoney frog in the fable. Here is an example:

A Stuart Oil customer was using Stuart's SpeedKut B Cutting Oil on his Brown & Sharpe automatics for threading SAE 1020 material. He was induced to try a "do-everything" product on the job. Picture A shows what happened! Picture B shows the same job machined with Stuart's SpeedKut. The "frog oil" didn't have enough cutting value.

Ask to have a Stuart Representative show you how the correct cutting fluid for the job, correctly applied, can save you time, money and material. Use the handy coupon below.



with "frog oil" — with Stuart's SpeedKut B

More Than a "Coolant" is Needed

D.A. Stuart Oil Co.
EST. 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

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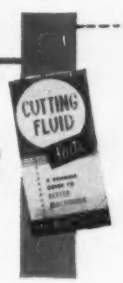

CLIP TO YOUR COMPANY LETTERHEAD AND MAIL

to D. A. Stuart Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.

Please ☐ Have Stuart Representative call

Check ☐ Send Booklet "Cutting Fluid Facts"

Your Name .....

Title .....

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(*Continued on page* 316)

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DETROIT DIE SET CORPORATION immediately on receipt of order ships all standard items in a wide range of sizes . . . dowel pins, die springs, stripper bolts, socket grip head cap screws and other accessories. All are nationally known products manufactured with the same precision as "DETROIT" die sets. For dependable shipment, 'phone, wire or write "DETROIT."
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DETROIT DIE SET CORPORATION
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DETROIT DIE SET ★

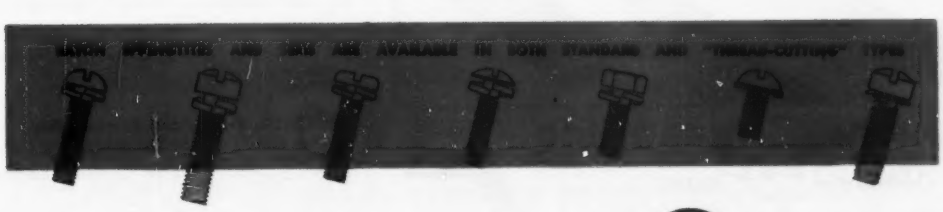
ELIMINATE
waste motions in production

SWITCH TO
Eaton Springtites and Sems

(Bolt or screw preassembled with spring lock washer)

The motions used by a production line worker on bolted assembly operations shown in figure 1 above differ from the motions used by the worker pictured in figure 2. This difference is graphically shown by light lines taken from actual factory production photographs. This difference in motions made possible by Eaton Springtites and Sems means higher production quotas and increased manufacturing profits. Why?

Because they are preassembled units, Eaton Springtites and Sems eliminate the need for assembling the spring lock washer on the bolt. Losses of separate washers and bolts are cut, while double requisitioning, purchasing, inventory is eliminated. Then too, Eaton Springtites and Sems are easy to use in hard-to-get-at places, and yet can be hopper fed for automatic screw driving. Most important, Eaton Reliance quality preassembled Standard ASA Spring lock washers and bolts assure greater product quality. See your nearest Reliance Sales Office for complete details on Eaton Springtites and Sems or write directly for Engineering Bulletin No. S-49.



RELIANCE DIVISION EATON MANUFACTURING COMPANY

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Perfected at Last!

Johnson

ALUMINUM-ON-STEEL SLEEVE BEARINGS

Are you one of the engineers who have been searching for a bearing metal with higher strength, higher load capacity and resistance to high engine temperatures? Improvements in machine design to reduce unit cost or improve efficiency often require greater loads on the bearings. Now you may design to use sleeve bearings with properties never available before.

These roll-bonded Aluminum-on-Steel Bearings may be used for loads up to 4000 P.S.I., yet have good conformability, good resistance to shaft wear, good resistance to corrosion, adequate seizure resistance and good resistance to fatigue. Tests prove that the bond to the steel back is as strong as the metal itself. These properties make Johnson Aluminum-on-Steel Bearings new high-load, high-speed bearings with a great future for high-load internal combustion engines.

JOHNSON BRONZE COMPANY
520 South Mill St. • New Castle, Pa.

Write today for further information

JOHNSON JB BEARINGS
Sleeve Type

JOHNSON BRONZE PRODUCES ALL TYPES OF SLEEVE BEARINGS: BRONZE-ON-STEEL, copper lead • STEEL BACK, Babbitt Lined • BRONZE BACK, babbitt lined • CAST BRONZE, plain or graphited • SHEET BRONZE, plain or graphited CAST ALUMINUM ALLOY • LEDALOYL powder metallurgy

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BALLS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Kennametal, Inc., Latrobe, Pa.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., (Coid Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Torrington Co., Torrington, Conn.

BEARINGS, Bronze and Special Alloy

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.

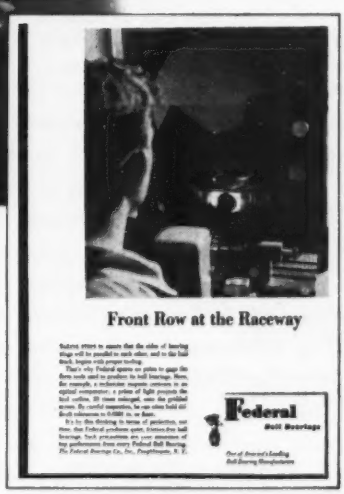
(Continued on page 318)

For quality control you can be proud of

When you have inspection and quality control procedures you're proud enough of to talk about, they must be good.

These three advertisements were published by firms justly proud of their methods. All three use Kodak Contour Projectors as an example of the type of care they exercise in producing products of uniformly high precision.

Optical gaging with a Kodak Contour Projector provides a fast, accurate method of production measurement and inspection. Operators can get the work out in a hurry—little training is required. Accessories are available to make possible measurement of the most complex shapes.



To see how a Kodak Contour Projector can help you reduce inspection costs, improve quality, send for our new 12-page booklet. It gives you details of both the Model 2A, for precision micrometry, and the Model 3, for fast, routine gaging. For your copy, write to:

Industrial Optical Division

EASTMAN KODAK COMPANY

Rochester 4, N. Y.

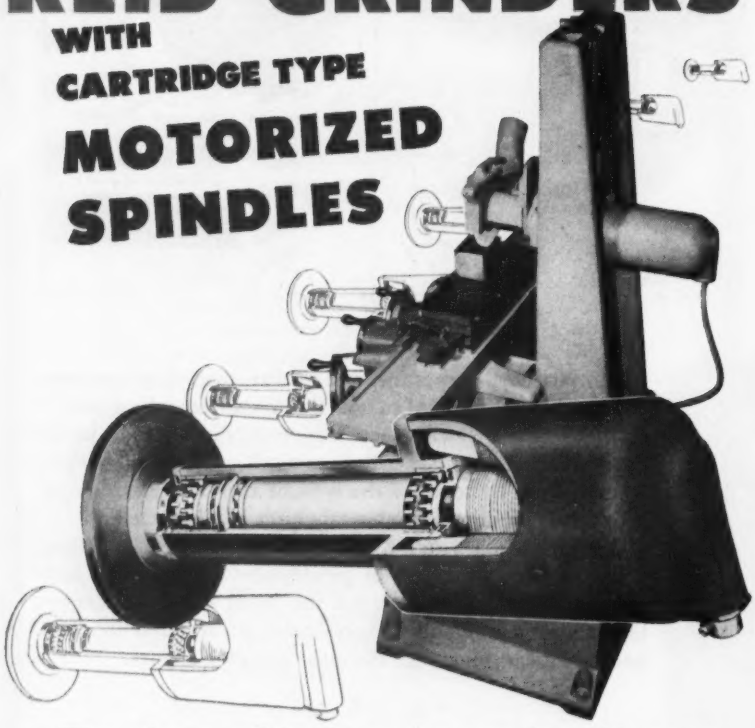
the KODAK CONTOUR PROJECTOR

Optical Gaging

A new sound movie, Optical Gaging, shows how to simplify complex inspection problems. We'll tell you how to get it for a showing.

Kodak

PRECISION
IS BUILT INTO
REID GRINDERS
WITH CARTRIDGE TYPE
MOTORIZED SPINDLES



When tolerances call for plus or minus a ten thousandth, you can rely on a Reid Precision Surface Grinder. Every Reid is equipped with a precision spindle, running on pre-loaded roller bearings and dynamically balanced to revolve with exact accuracy at peak loads. Sealed-in lubrication of bearings and motor *keeps* these spindles performing with a minimum of attention, year after year.

- Standard-size, interchangeable within minutes
- Wheel guard with hinged cover allows quick wheel change
- Adjustable dust guard spout to suit thickness of work being ground
- Extra rigidity eliminates chatter — increases production
- Sealed-in lubrication protects bearings from dust and dirt — reduces friction for cool running
- For jobs requiring the spindle in vertical position, a special bracket, furnished by Reid, is all that is necessary for conversion

Cartridge type motorized spindles with 3" diameter quills, as manufactured by: Pope, Ex-Cell-O, Whitnon and Parker may be used with Reid Grinders.

Reid Precision Grinders (the result of 53 years of experience) will improve the quality and capacity of *your* shop. Find out why Reid is the choice of industry for precision grinding. Write for Bulletin 618-2.

Reid Brothers Company, Inc.

BEVERLY, MASSACHUSETTS

Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller
Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless)
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust
Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracekn St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Shafer Bearing Corp., Downers Grove, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING TRANSMISSION
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

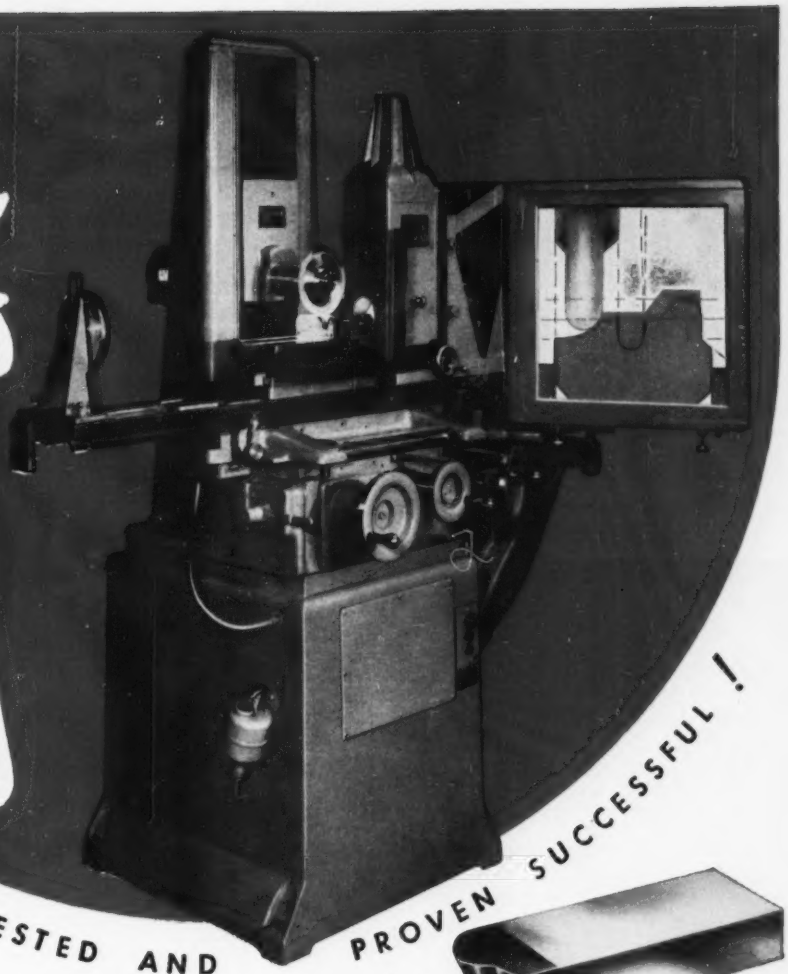
BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
O'Neil-Irwin Mfg. Co., Lake City, Minn.

BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

(*Continued on page* 322)

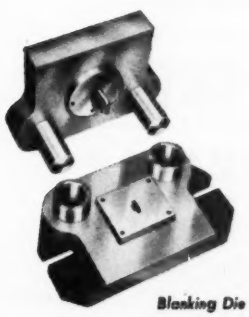
Positive Results with VISUAL GRIND

TRADE MARK

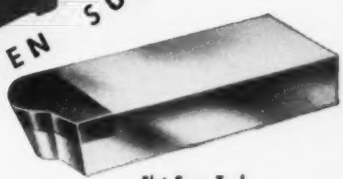


TESTED AND PROVEN SUCCESSFUL !

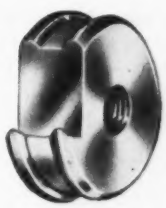
Progressive Die



Blanking Die



Flat Form Tool



Circular Form Tool

Dovetail Tool

Here is precision contour grinding at its best. Steel and tungsten carbide form tools, die sections, templates and related items are efficiently processed in dependable, economical fashion. Our basic magnetic chuck work-holder affords positive positioning yet with flexibility for cam, circular and index grinding with the proper fixtures. Workpiece quality is controlled visually at all stages, either while using pre-dressed grinding wheels or when generating the required contour by means of successive, controlled movements. Durable construction around precision optics insures rigidity and long life.

Ask for Bulletin "M-6"

VISUAL GRIND

THE CLEVELAND GRINDING MACHINE COMPANY

1643 EDDY ROAD • CLEVELAND 12, OHIO

New Possibilities in Optical Grinding

You could dot an (i) with this cutting tool

HERE'S THE START OF A NEW CONCEPT THAT CREATED CINCINNATI GRINDING WHEELS

The tiny grinding grit is the starting point of an entirely new approach to grinding wheels. Cincinnati Milling has proved, beyond doubt, that the grinding process is a true metal cutting process. The grinding grits do not abrade or wear away the surface of a workpiece but form chips which agree in classification with the basic chip types found in other metal cutting processes.

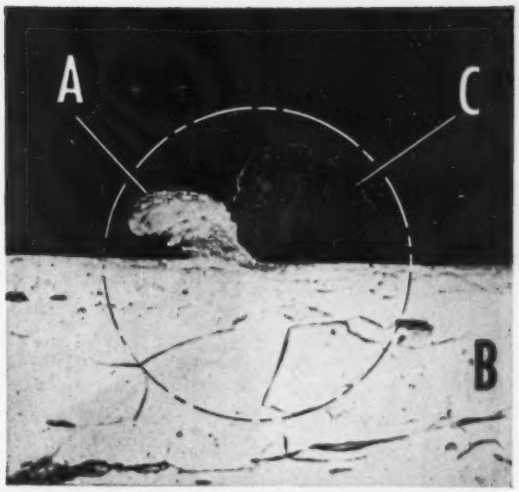
This new concept is not based on hasty conclusions. It represents 25 years of Cincinnati Milling research, coupled with practical experience in applying the basic fundamentals of grinding to a wide variety of work on both centerless and centertype machines.

Here is the starting point of development of the grinding wheel as a true cutting tool. And it is a development you might expect from Cincinnati Milling, with the world's largest background of research and experience in metal cutting operations.

For you, this means grinding wheels developed and

tested over a period of several years on the basis of true function—as true cutting tools forming true chips.

Available to you is a field organization of trained machinists who know grinding and grinding machines as well as grinding wheels. For a demonstration on your own machines of how to get the most out of Cincinnati Grinding Wheels, write, wire or phone Cincinnati Milling Products Division, The Cincinnati Milling Machine Co.



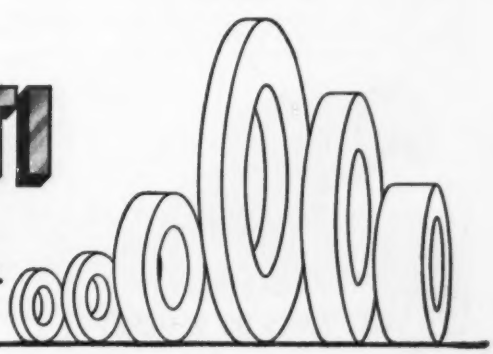
FROZEN ACTION—Tiny steel chip (A) is shown being cut from workpiece (B) by a grinding grit (C).

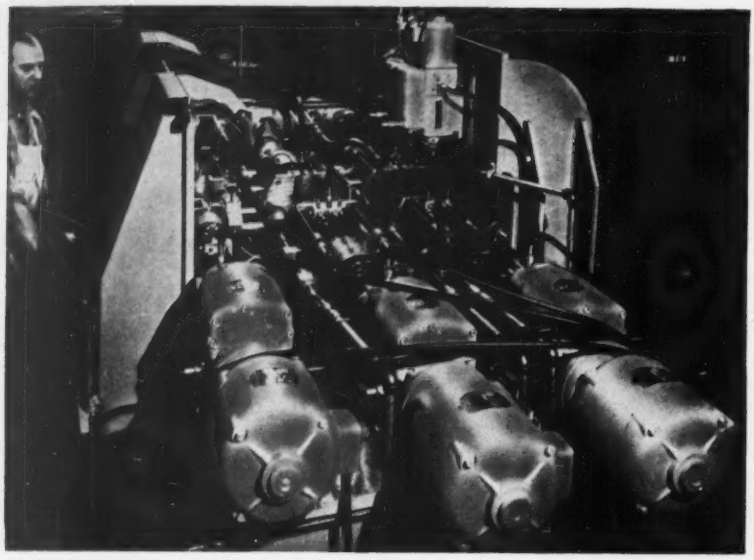
RESEARCH WORKER shown here is using optical instrument to check tiny deflections resulting from grinding forces.

FAMOUS NAME is stenciled on a wheel that has passed a battery of tests and is ready for shipment to one of the ever increasing number of customers.

FREE BOOKLET. Now available to industry is a new booklet entitled "A New Concept In Grinding Wheels." It contains valuable information for everyone interested in grinding operations. And a copy is yours for the asking. Just write Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio





Machine Details
Dimensions: 10¾' long, 6½' wide, 7' high; weight about 16,000 lbs. 8 Delta drill units: 6 Model 19-400; 2 Model 19-150. 5 drill units equipped with multiple-spindle drill heads. Total HP—13.

Control Panel
Selector switches make possible any combination of 3 positions, 8 stations—a universal machine. Operator presses a starting button; sequence of operations is automatic; machine stops automatically when work is finished. 3000 feet of wiring between panel and machine.

From 25 minutes to 2 minutes

-that's the time saved by A.B.DICK CO.

with 8 DELTA AIR-POWERED HYDRAULIC DRILL UNITS

When conventional tools required 25 minutes to complete 9 holes in a spirit-duplicator cylinder, A. B. Dick engineers built their own special horizontal drilling machine, using 8 Delta air powered hydraulic drill units, and now do the job in less than two minutes.

Their new machine drills, spot faces and reams 9 holes in aluminum cylinders—needs but a single operator, has automatic remote control.

Operation of this 3-position, 8-station machine consists of loading and pressing the starting button. The Delta drill units operate in four banks, in automatically controlled sequence of drilling, spot facing, milling and reaming. When the cycle is completed, the finished piece returns to original position and the machine stops. It is universal—handles any piece up to 12" diameter and 24" length.

"This machine is so fast and so accurate," says Edward Brenn, design engineer, "that 3 or 4 days use per month is ample to keep up with production demand. The operator is free for other duties. We just didn't have the equipment to do this job economically—so we built the machine ourselves."

Three Delta air powered hydraulic drill unit models are now available to meet your specific requirements—1½", 4" or 6" stroke; No. 80 to 1" diameter drill. See your authorized Delta drill unit dealer—write for new catalog.

DELTA QUALITY MACHINE TOOLS
Another Product of **Rockwell**

DELTA QUALITY MAKES THE DIFFERENCE

Delta Drill Unit Division
Rockwell Manufacturing Company
614F N. Lexington Avenue,
Pittsburgh 8, Pa.

☐ Please send catalog AD-723.
☐ Send name of nearest authorized Delta drill unit dealer.

Name_____
Position_____
Company_____
Address_____
City_____ Zone____ State_____

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Pines Engineering Co., Inc., Aurora, Ill. (Hydraulic)
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT

Pangborn Corp., Hagerstown, Md.
Wallis Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Nutional Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOLTS, T-Slot

Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

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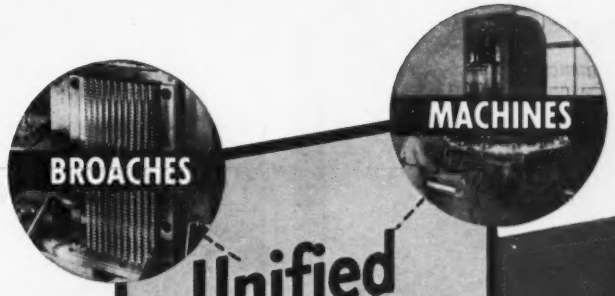


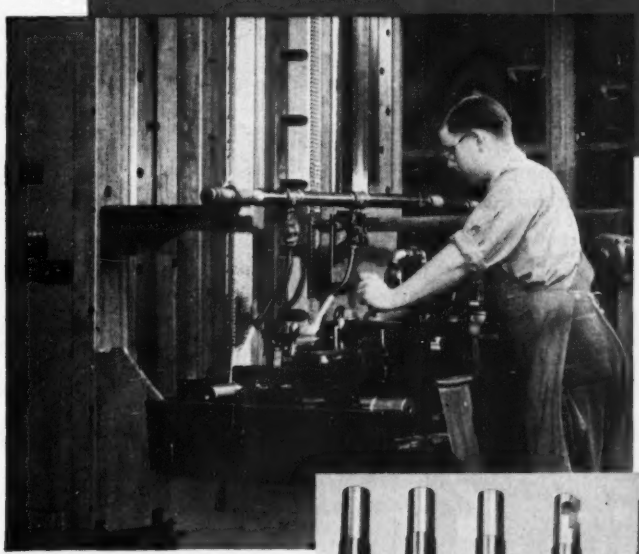
For Top Output

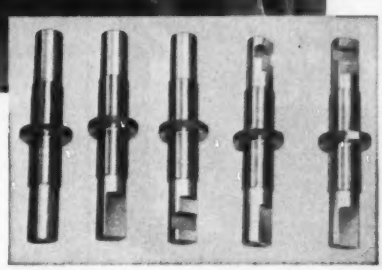
the COLONIAL method

At Colonial, experience, imagination and competence are applied

1 to the design and manufacture of each of the individual components of a complete broaching installation, and

2 to the effective combining of ALL components into a completely UNIFIED BROACHING installation—making them work as a "team."





252 Operations per hour on One Machine

252 broaching operations on the four stations of their 25-ton, 90-inch stroke Colonial Dual Ram give Caterpillar Tractor Co. a production of 63 track roller shafts of either of two types per hour. Shafts are heavy steel forgings 2½" x 18" with a 4½" flange.

Shafts are shown in broaching sequence, with the shaft to be broached at left.

Caterpillar reports "very little maintenance" on this UNIFIED BROACHING installation.

Machines, broaches, fixtures, etc., were all designed by Colonial as a UNIFIED BROACHING INSTALLATION.

WHAT'S AHEAD IN BROACHING?

Keep up with the latest developments: Read "Broaching News". We will be glad to see you get it regularly if you will drop us a line on your company letterhead.

PIONEERS OF H.S.S. BROACHING

COLONIAL BROACH CO. DETROIT 13

OVER ONE HUNDRED YEARS OF CONTINUOUS SERVICE. ROUNDS, SQUARES, FLATS, HEXAGONS, OCTAGONS

HY-TEN

"B" No. 3X HEAT-TREATED BARS

BILLETS AND FORGINGS FOR PRODUCTION, TOOL ROOM AND MAINTENANCE REQUIREMENTS

This higher-priced alloy steel can save you money!

"B" No. 3X heat-treated bars offer many production economies, even though machined at about ¾ths the speed of annealed bars. They are supplied to your desired physical properties, and can be machined more easily than standard heat-treated bars with equivalent properties. The expense of scaling, distortion, straightening, and often grinding, are eliminated — as well as the cost of extra handling and heat treating of finished parts!

Although the cost is a little more than for ordinary annealed stock, a trial order will convince you of the true economy of HY-TEN "B" No. 3X heat-treated bars! Just call your nearest WL representative.

Write today for your FREE COPY of the Wheelock, Lovejoy Data Book, indicating your title and company identification. It contains complete technical information on grades, applications, physical properties, tests, heat treating, etc.

WHEELOCK, LOVEJOY & COMPANY, INC.

Warehouse Service

CAMBRIDGE • CLEVELAND
CHICAGO • HILLSIDE, N.J.
DETROIT • BUFFALO
CINCINNATI

In Canada
SANDERSON-NEWBOULD, LTD., MONTREAL

HY-TEN and AISI

138 Sidney St., Cambridge 39, Mass. and Cleveland • Chicago • Detroit Hillside, N. J. • Buffalo • Cincinnati

National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Tripiex Machine Tool Corp., 75 West St., New York 6, N. Y.

BORING BARS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamiiton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejov Tool Co., Inc., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadvilie, Pa.
Universal Engineering Co., Frankenmuth 2, Mich.

BORING, DRILLING AND MILLING MACHINES, Horizontal

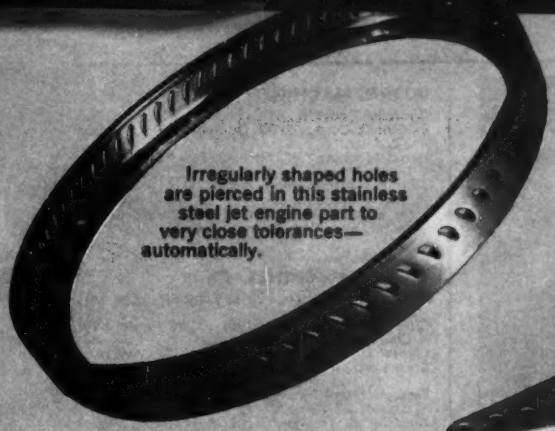
(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Portage Machine Co., 1069 Sweitzer Ave., Akron 11, Ohio.
Precise Products Corp., 1328-30 Clark St., Racine ,Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

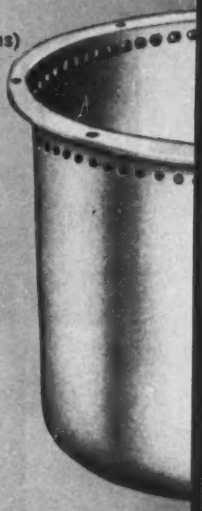
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
troit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Mummert-Dixon Co., Hanover, Pa.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

(*Continued on page 326*)



Irregularly shaped holes are pierced in this stainless steel jet engine part to very close tolerances—automatically.

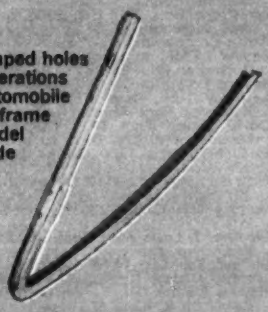
More than 40 holes in this automotive frame member are pierced simultaneously.



Cylindrical parts can be pierced (or related operations) from the outside in or inside out using an indexing type machine.

High Production Piercing...

IN A SINGLE SET-UP



Seven irregular shaped holes and two trimming operations complete this automobile door inner window frame in one setup. Model changes can be made at little expense.

Based on a recent development in piercing technique, you can pierce more holes simultaneously—faster and with greater accuracy—on Danly Metalworking Equipment. Eliminate awkward multiple handling . . . pierce all holes faster in a simple, single set-up.

Built specifically for your piece part, these are only a few of the advantages of Danly Hydraulic Metalworking Equipment:

FREE

Write for this Bulletin today!

Consider these important features!

- ***HIGH CAPACITY***—Up to 225 tons available per cylinder.
- ***BREAKTHROUGH SHOCK PRACTICALLY ELIMINATED***—Permits greater capacity without hydraulic circuit or tool trouble . . . smoother, faster.
- ***AUTOMATIC STRIPPING***—An integral feature of every cylinder . . . each station hydraulically strips its punch. This unique action simplifies fixturing, is practically foolproof.
- ***ACCURACY, FLEXIBILITY***—Pierces practically any type of hole . . . round, oblong or irregular to very close tolerances.

DANLY®

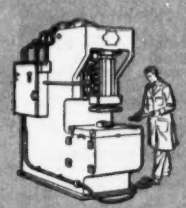
DANLY MACHINE SPECIALTIES, INC.

2100 South Laramie Avenue • Chicago 50, Illinois

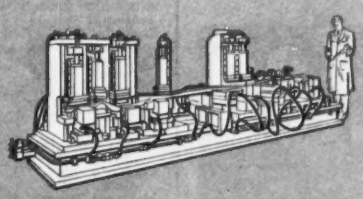
HYDRAULIC METALWORKING EQUIPMENT

MECHANICAL PRESSES 50 TO 3000 TONS

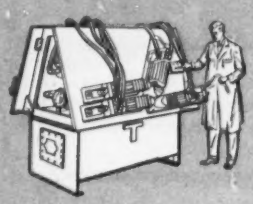
DANLY HYDRAULIC METALWORKING EQUIPMENT



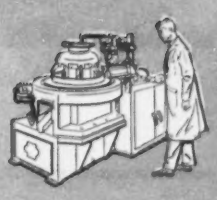
General Purpose Gap Frame Piercing Press



Automotive Frame Piercing Machine



Automotive Inner Window Frame Piercing Machine



Jet Engine Shroud Ring Piercing Machine

Off on a Carefree Vacation!

He just contracted with Vinco to produce component parts.

This confidence in Vinco is typical of many manufacturers from coast to coast. They have learned that whether the parts to be produced have close or loose tolerances, these parts will be delivered as specified, at a minimum cost and with a minimum of scrap.

VINCO CORPORATION
9113 Schaefer Hwy.
Detroit 28, Mich.

Mass Produced Parts
Gears
Gear Pumps
Spline Gages
Aircraft Gears

VINCO

MILLIONTHS OF AN INCH FOR SALE

THE TRADEMARK OF DEPENDABILITY.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Ferrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

BORING TOOLS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Wis.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejoy Tool Co., Inc., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
OK Tool Co., Milford, N. H.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BRAKES, Press and Bending

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss, E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Peck, Stow & Wilcox Co., Southington, Conn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

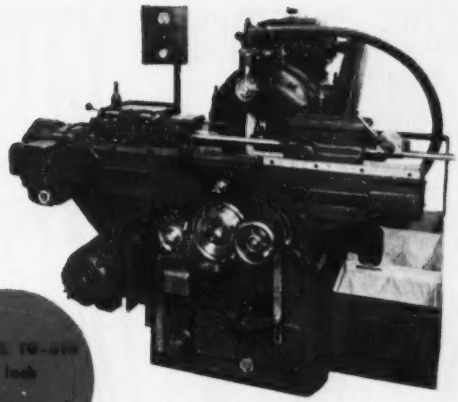
BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Detroit Broach Co., 20201 Sherwood Ave., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

(Continued on page 328)

Quality threading

AT MINIMUM COST



MODEL TG-6[illegible]
6 x 15 Inch

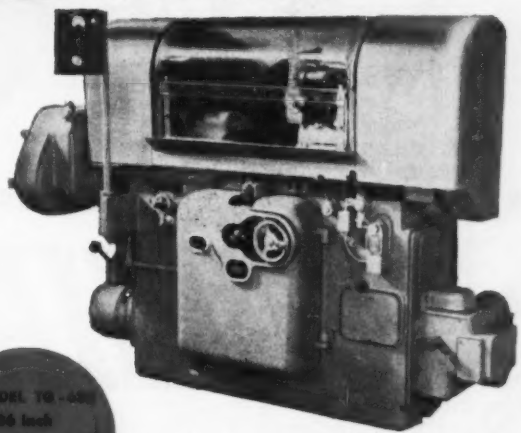
The 6 x 1[illegible] Automatic Thread Grinder is used for high production thread grinding with either single or multi-ribbed wheels on relatively small parts.

JONES & LAMSON AUTOMATIC THREAD GRINDERS:

- Produce threads of better quality and more uniform finish
- Reduce handling cost
- Eliminate costly rethreading after heat treatment
- Eliminate expensive retooling when specifications change
- Reduce cost of gage maintenance

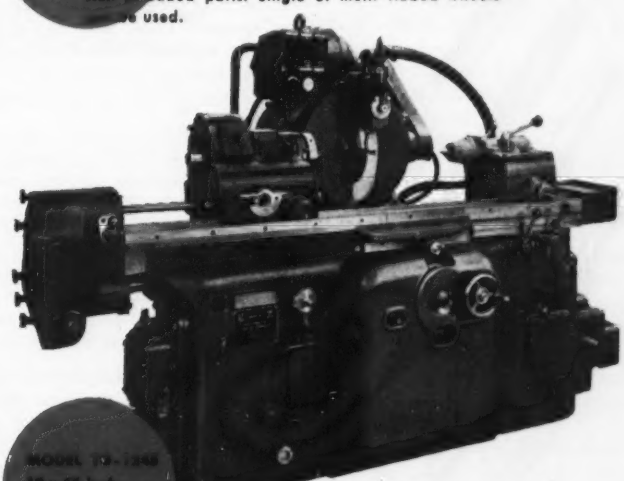
Built-in accuracy and automatic features, make any of these machines a paying investment for toolroom or production line.

- Automatic wheel truing
- Automatic infeed on successive cuts
- Automatic sizing
- Rheostat wheel speed control
- Diamond or crush dressing of wheels
- Multi-ribbed threading
- Right and left hand threading



MODEL TG-[illegible]
6 x 36 Inch

The 6 x [illegible] machine is extremely versatile and is used on long or short run jobs on a great variety of precision threaded parts. Single or multi-ribbed wheels may be used.



MODEL TG-[illegible]
12 x 48 Inch

The 12 x 48 machine is used for grinding threads on a wide range of work from small to large heavy parts. Single or multi-ribbed wheels can be used.

When measuring the value of a thread grinder remember the extra benefits of J & L top-flight construction. Write Dept. 710 for illustrated catalog.

JONES & LAMSON

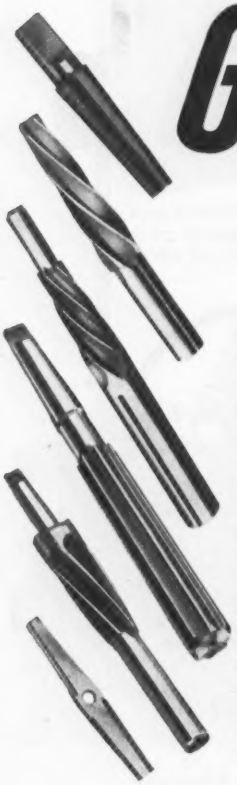
Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

THREAD GRINDER DIVISION

FOR SPECIAL REAMERS . . . REMEMBER

GORHAM



They may not *look* alike, but all of the special tools on this page share a common function . . . *because every one is a reamer!* Each was engineered and manufactured by Gorham Tool Company to provide a practical solution to a specific production machining problem for one of our customers.

Actually, these reamers represent just a few of the many special-purpose cutting tools produced by Gorham. Others include milling cutters and end mills, inserted blade cutters, flat and circular form tools, profile cutters, and carbide tipped tools of every description. Gorham "specials" are turning problems into profits in thousands of plants every day . . . and the one we engineer for you will solve *your* next production machining problem, too! Take advantage of our experience.

Your nearby Gorham Field Engineer is a qualified cutting tool expert in both practical design and actual application, and his assistance is yours without obligation. Just write for his name, or send details of your problem direct to us. We'll have him get in touch with you promptly.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14405 WOODROW WILSON • DETROIT 3, MICHIGAN

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Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Johnson Bronze Co., New Castle, Pa.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Atrax Co., Newington, Conn.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened

Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.

BUSHINGS, Jig

Colonial Bushings, Inc., P. O. Box 37, Harper Sta., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

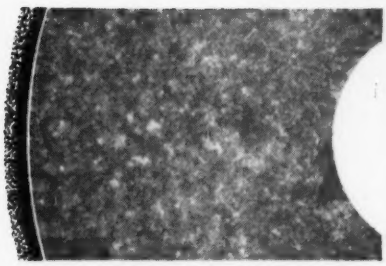
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

(*Continued on page* 330)

GRADUATED DENSITY

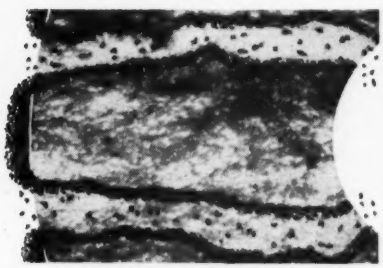
makes MICRO-KLEAN the most effective filter on the market!

How MICRO-KLEAN compares with other cartridge filters



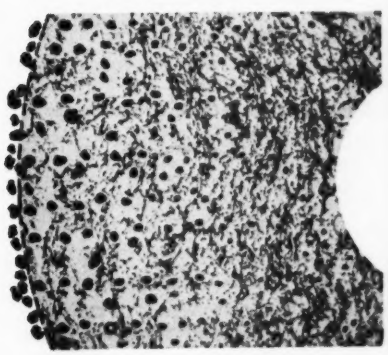
***Compare* MICRO-KLEAN with**

FILTERS WITH THE SAME DENSITY THROUGHOUT. The filter media density is the same on the pressure and discharge surfaces of the element; therefore, dirt accumulation is largely on the outside surface, choking the cartridge ("plastering") and reducing the effective filter life.



***Compare* MICRO-KLEAN with**

FILTERS WITH HAPHAZARD DISTRIBUTION OF FILTER MEDIA. Uneven haphazard media density permits fluid to find channels through the filter, and pass solids larger than the minimum filter spacing.



***Now Look* at the advantages offered by MICRO-KLEAN.** See how the fibre density increases toward the discharge side of the MICRO-KLEAN filter cartridge? In effect, every Cuno MICRO-KLEAN cartridge is an infinite multiplicity of screens, ranging from relatively coarse on the outside down to 10 microns in the center. Because of MICRO-KLEAN'S graduated density in depth, particles are entrapped within the entire depth of the filter element, giving the cartridge a much longer effective life. Standard cartridge size is 9¾" long by 2¾" O. D., in densities of 10, 25 and 50 microns.

MICRO-KLEAN gives you

- **greater dirt holding capacity**
- **absolute protection against rupturing or channeling of the cartridge**
- **longer effective cartridge life**

REMEMBER . . . IF YOU CAN PUMP IT, CUNO CAN FILTER IT

M.3.C

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

COMPACT, FULL-FLOW FILTRATION FOR INDUSTRIAL FLUIDS

Fewer Cartridge Changes Necessary with MICRO-KLEAN filters

You don't need a complicated, bulky filter to keep contaminants out of your chemicals, water, lube or fuel oils. Cuno MICRO-KLEAN's compact construction gives you full-flow filtration in space which would limit ordinary filters to by-pass service.

The high porosity and low pressure drop operation of MICRO-KLEAN filters permit this full-flow service on gravity, low pressure, or suction lines—with no loss in operating efficiency.

Cartridge replacement costs are generally cut in half when MICRO-KLEANS are used. MICRO-KLEAN's graduated density-in-depth provides much greater capacity for dirt accumulation within the micronic cartridge, giving twice the useful life of an ordinary filter element.

Cuno's exclusive method of felting fibres produces a cartridge of great structural strength, free from channeling or distortion and entirely unaffected by moisture or acids. And changing cartridges can be accomplished in a few seconds—only one nut has to be removed.

Send for Cuno's free filtration analysis form, have one of your engineers fill it out, and mail it to us. We'll let you know exactly what you need for your filtration requirements—without obligation. And take advantage of Cuno's unique "money-back" offer. If MICRO-KLEAN doesn't outperform any filter cartridge you have previously used, we'll send you *double* your money back. Send the coupon today for free MICRO-KLEAN bulletin. M.3.5

Cuno Engineering Corporation
Dept. 135-C, South Vine Street, Meriden, Conn.

I'm interested in your "money-back" offer. Please send me your filtration analysis form—and more information on MICRO-KLEAN for

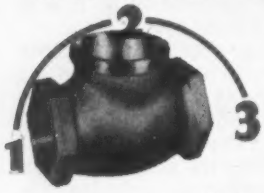
..... (fluid)

Name.....

Company.....

Address.....

City.....Zone....State.....



AUTOMATIC CHUCKING MACHINE

There are no half-finished pieces lying around at the end of the day when you put your work on this outstanding machine.

The "1-2-3" feature—available only on the Goss & De Leeuw Automatic Chucker —provides the means of finish machining three ends of a part without changing set-up.

Note some of the typical parts machined. Ask for illustrated literature giving further details and send samples of your work for a cost estimate on handling it on the Goss & De Leeuw.

GOSS & DeLEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

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Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rowbottom Machine Co., Sheffield St., Waterville, Waterbury, Conn.

CAMS
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Sheffield St., Watervilie, Waterbury, Conn.

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Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES
See Furnaces, Heat-Treating.

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Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

CASTINGS, Die
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Iron
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Hansell-Elcock Co., 485 W. 23rd Place, Chicago 16, Ill.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.
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Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

(Continued on page 332)

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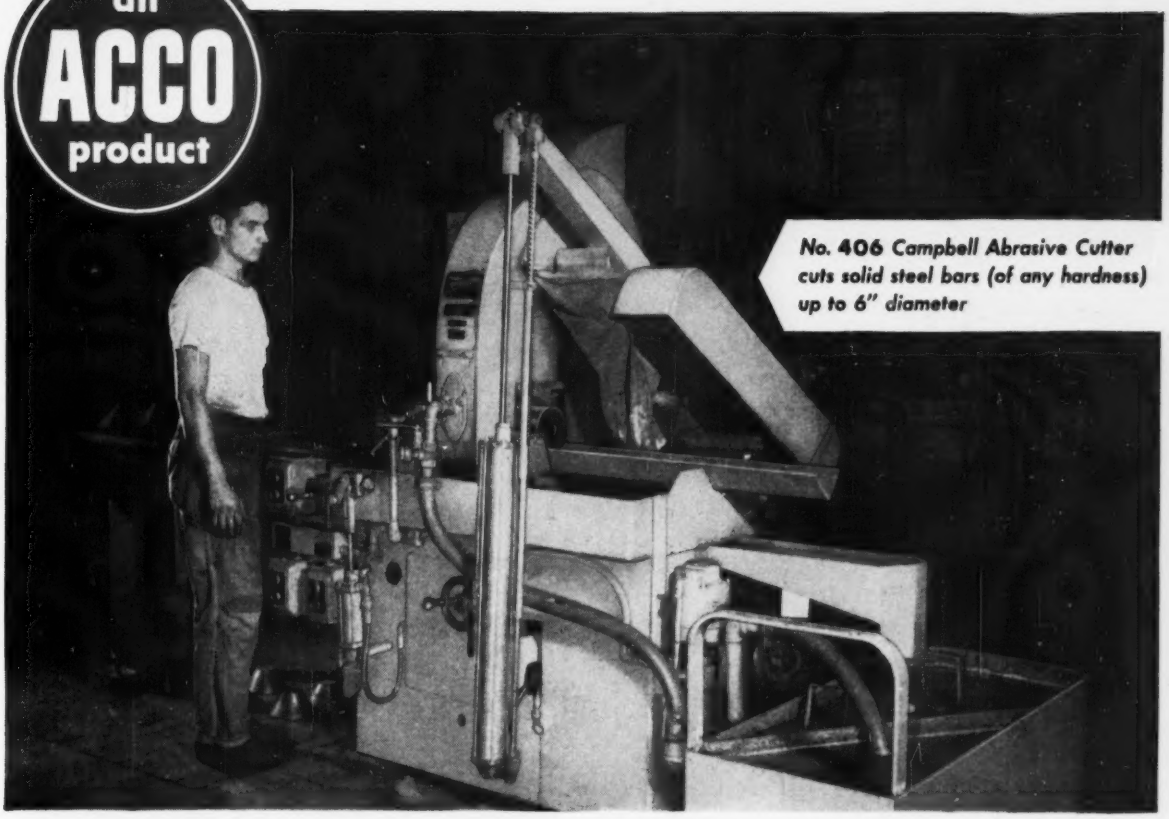

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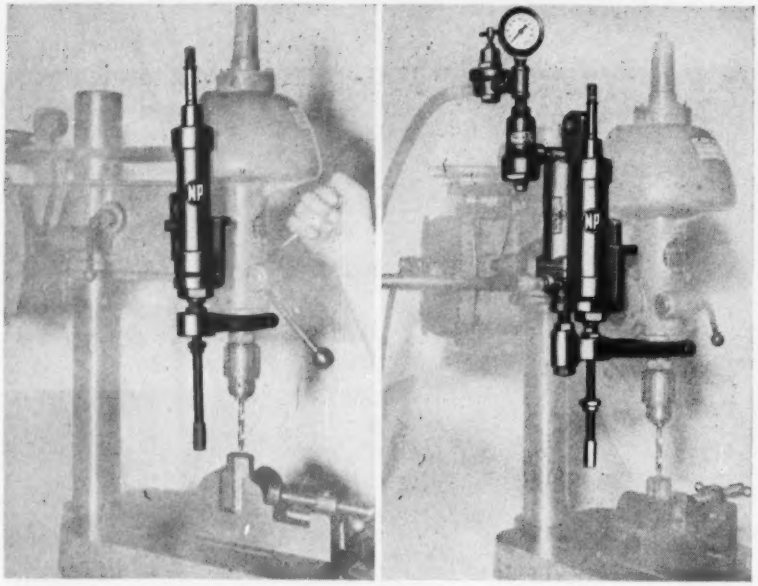

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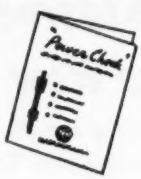

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Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
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Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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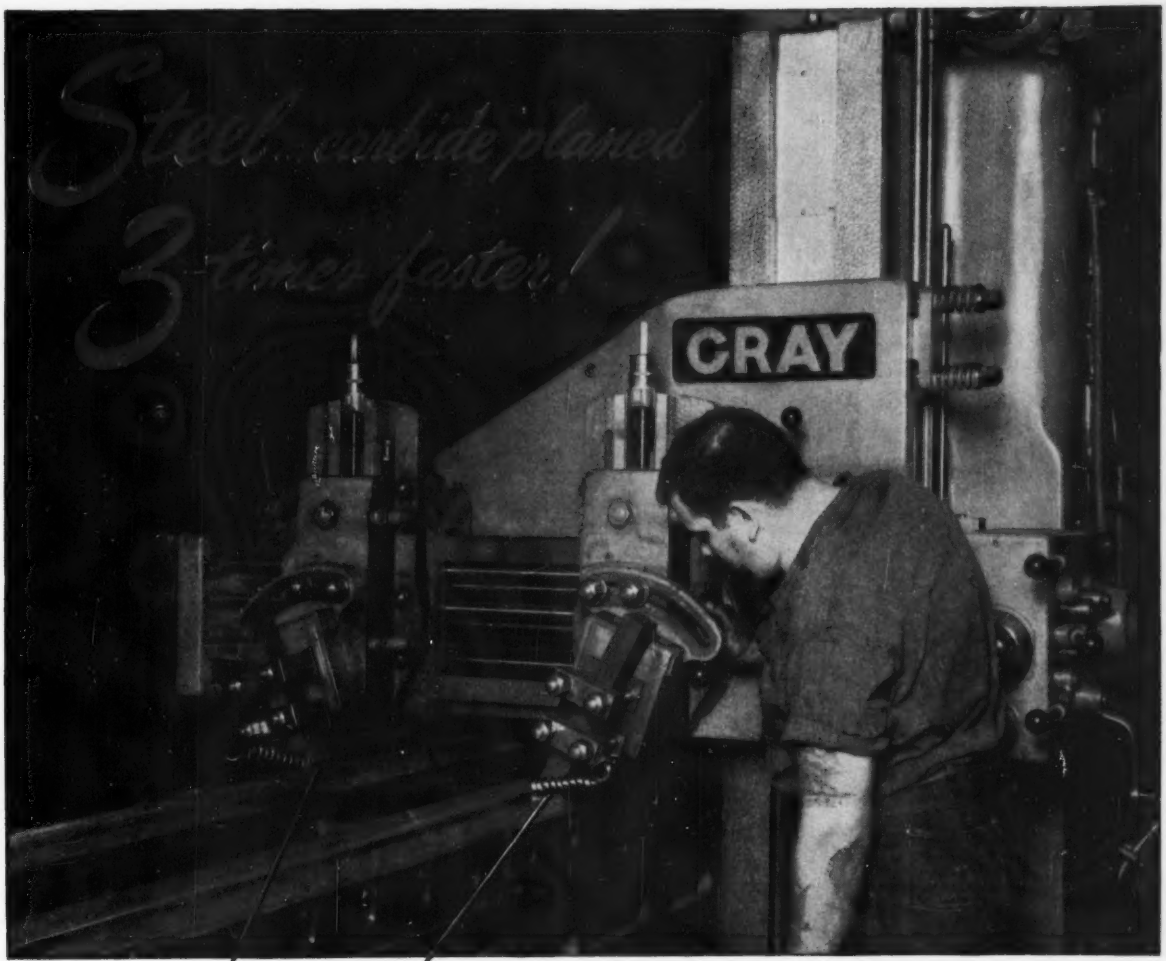

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Universal Engineering Co., Frankenmuth 2, Mich.

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Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

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(*Continued on page* 336)

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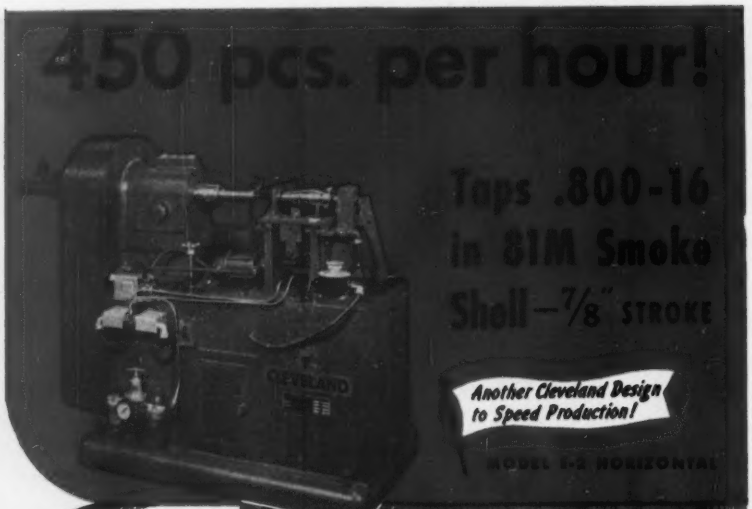

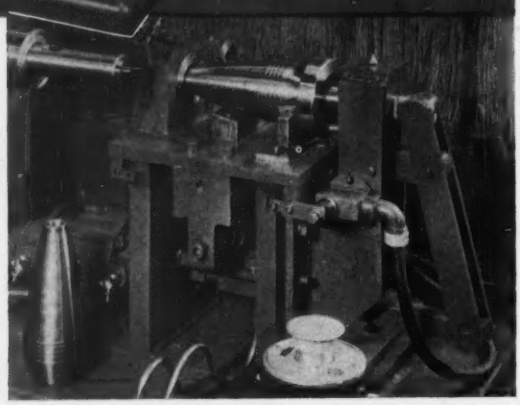

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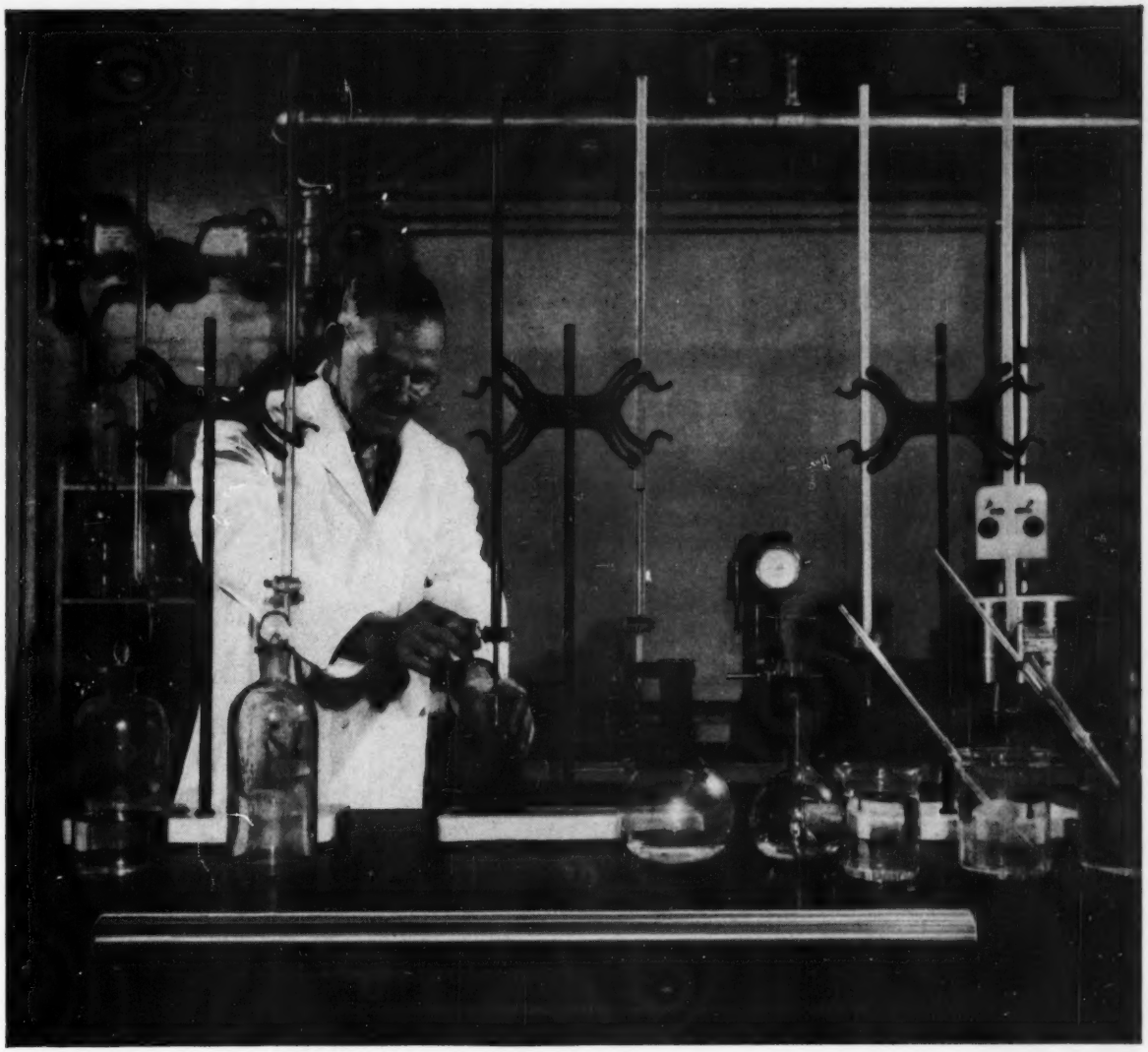

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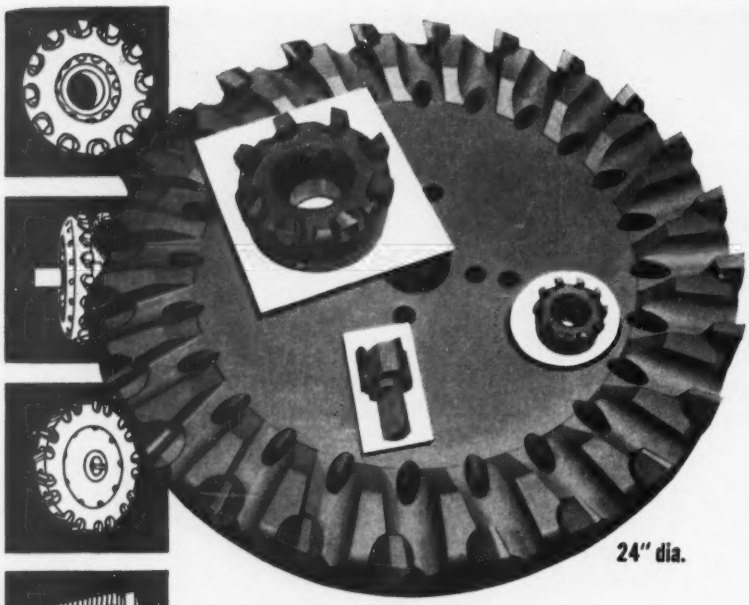

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
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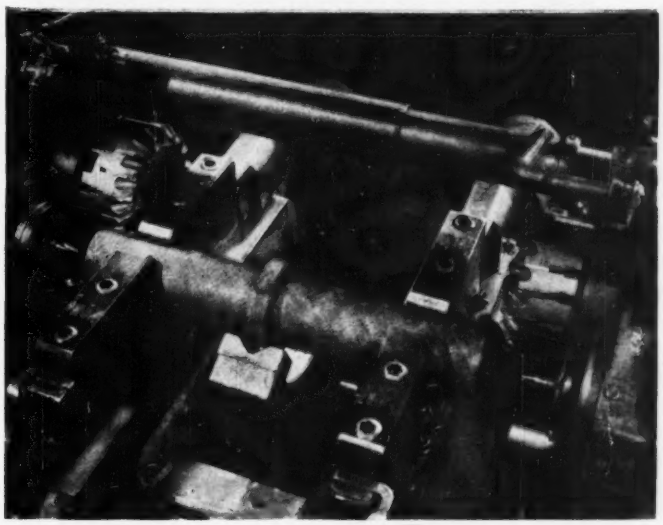
(*Continued on page* 340)

WESSONMETAL

CORNERSTONE for METAL WORKING PRODUCTION



150% INCREASE IN OUTPUT
PER DOLLAR SPENT FOR
WESSON TOOLING

COMPLETE PRODUCTION STORY ON THE CATERPILLAR TRACK ROLLER SHAFT

Machine.....Fay automatic lathe
Part Machined...Track roller shaft
Operation.....Milling and centering
Material.....1046 steel
Tools.....6¾" dia. Wesson Rigidcut Milling Cutter—18 blades
Speed.....320 S.F.M
Depth of Cut.....¼" to 7/16'
Feed.....15" per min
Feed per Tooth.....005'
Feed on Center Drill.....006'
Production.....400 pcs. per grind; 50 pcs. per hour
Grade of Carbide..Wessonmetal WH

OLD METHOD	WESSON ENGINEERED METHOD
Pieces Per Grind.....166	Pieces Per Grind.....400
Tool Cost Per Piece...$0.0716	Tool Cost Per Piece..$0.0285
Grinding Hours Per Year.....420	Grinding Hours Per Year.....183.33

ON 1 JOB WITH 1 WESSON TOOL SAVINGS OF OVER $2400.00 PER YEAR

WESSON METAL CORPORATION
LEXINGTON, KENTUCKY
Affiliated with WESSON COMPANY, Detroit, Mich.

WESSONMETAL Cemented Carbide

Announcing the New

WERNER
#5 AND #6
VERTICAL
MILLERS

forty horsepower (50 h.p. optional)

Forty-two spindle speeds from 16 RPM to 1800 RPM
Fifty table feeds from 9/32" to 80" per minute
#5 table 20" x 90" • #6 table 20" x 110"

Rise and fall table with manual or fully automatic cycle.

Preselector for spindle speeds and table feeds. Feeds may be changed while cutting.

Foolproof table clamps open automatically when feed is engaged.

Converts instantly from a tool room miller to an automatic production machine.

Many more new and unique features

•

Plain #5 and #6 Millers also available

•

Inquiries are invited about smaller Werner Millers, sizes 0 to 4, with tables from 6"x 20" up to 16"x 72"

Prompt and reasonable deliveries

FOR FURTHER INFORMATION WRITE, WIRE, PHONE

MARAC Machinery Corp.

1819 BROADWAY, NEW YORK 23 • CI 7-2048

Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS
Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Peck, Stow & Wilcox Co., Southington, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution
Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S. Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUNTING DEVICES
Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUPLINGS, Flexible
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Southwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Morgan Engrg. Co., Alliance, Ohio.

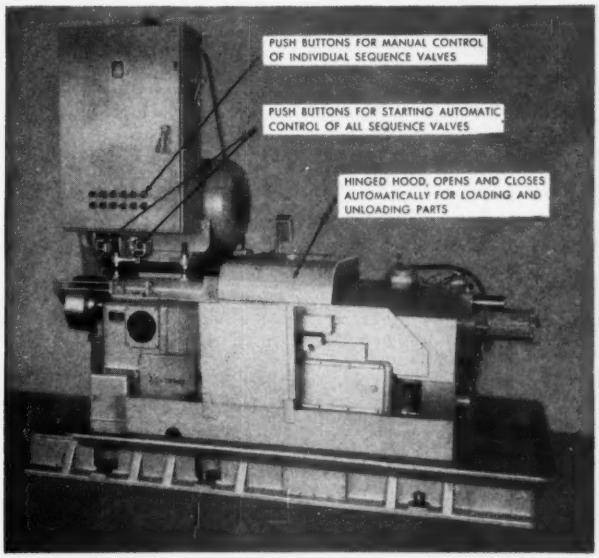
CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

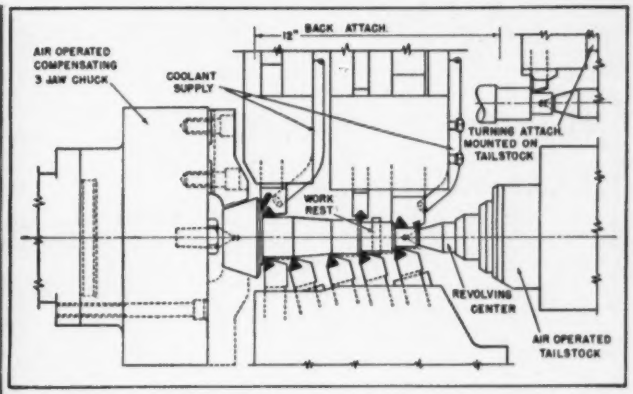
CUTTERS, Gear
Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.

(*Continued on page* 342)

MACHINE OF THE MONTH

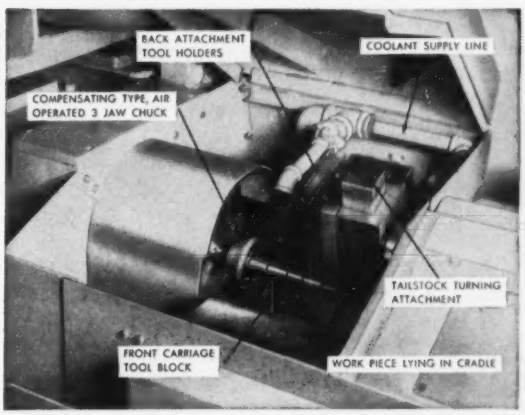
PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK


PUSH BUTTONS FOR MANUAL CONTROL OF INDIVIDUAL SEQUENCE VALVES
PUSH BUTTONS FOR STARTING AUTOMATIC CONTROL OF ALL SEQUENCE VALVES
HINGED HOOD, OPENS AND CLOSES AUTOMATICALLY FOR LOADING AND UNLOADING PARTS



◀ *Tooling area of machine is entirely enclosed, protecting operator from flying chips and coolant.*

▼ *Hinged hood in open position for loading and unloading parts.*


BACK ATTACHMENT TOOL HOLDERS
COOLANT SUPPLY LINE
COMPENSATING TYPE, AIR OPERATED 3 JAW CHUCK
TAILSTOCK TURNING ATTACHMENT
FRONT CARRIAGE TOOL BLOCK
WORK PIECE LYING IN CRADLE

Lo-swing LATHE EQUIPPED WITH AUTOMATIC CONTROLS REDUCES HANDLING TIME...

Problem: **To reduce handling time and operator fatigue in machining operations on Axle Pinions.**

Solution: **A Model AR Automatic Lo-swing Lathe, tooled as illustrated, was selected for this job. Work is held on centers and driven with an air-operated, three-jaw compensating chuck. Five carbide front turning tools, two of which are template operated, reduce the length of cut to 1-7/8", which is the length of the taper portion. An additional tool, mounted in a tailstock turning attachment, partially removes surplus material on the threaded diameter in advance of the front turning tool which finish turns this diameter. Six carbide tools on the rear slide face and chamfer the shoulders.**

The machine stops automatically at the end of the cycle with spindle stopped, chuck jaws released, tailstock center retracted, hinged hood open and with the machined part dropped into a cradle. The operator simply replaces the finished part with a rough forging and then pushes the two starting buttons, energizing the loader controls, which consecutively close the hood, places the work between centers, closes the chuck jaws and finally starts the headstock spindle rotation. The automatic cycle from then on is controlled by automatic camming built into the base machine.

The tooling area of the machine is entirely enclosed to protect the operator from flying chips and coolant, while cutting at high spindle speeds. Two starting buttons, wired in series, oblige the operator to use both hands, and are so located that the operator is out of range of the closing hood, thereby preventing accidents.

Control buttons on the door of the starter panel permit normal operation of individual controls and are convenient for setting up and timing loader movements.

Seneca Falls engineering staff is at your disposal to help solve your engineering problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

Get EXTREME ACCURACY—

Use

OLIVER ACE

Universal Tool and Cutter Grinders

Direct Reading for Clearance
—Reduces Fatigue
—Eases Operators' Jobs

Grinding cutters quickly and accurately is a must in the modern toolroom. Oliver Ace grinders have been turning out precision-sharp cutters in toolrooms everywhere for years, gaining a solid reputation for their ease, speed and simplicity of operation. The Oliver Ace is easy on the operator too, since it requires no computation yet handles a wide range of cutter grinding. It's faster on most grinding operations—the set-up is simple—the direct reading for clearance reduces fatigue, eases operators' jobs (no stoop . . . no squat . . . no squint).

Oliver Ace Cutter Grinders have proved their dependability. They're soundly engineered, efficient, and economical to operate. They easily grind the most difficult cutters—giving guaranteed accuracy—excelling on high speed and Tungsten-Carbide work.

Priced to meet your budget, the ACE excels for grinding face mills up to 15"—also, slab mills • slitting saws • dovetail cutters • angular cutters • double angle cutters • Fellows helical cutters • reamers • taper reamers • production gashing. See our catalog in Sweet's Directory

2 MODELS: Standard and Heavy Duty (illustrated)
Write Today for Complete Data

OLIVER INSTRUMENT CO.
1410 E. MAUMEE • ADRIAN, MICHIGAN

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Michigan Tool Co., 7173 E. McNichols Rd., Detroit 12, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Douglas Tool Co., 2300 E. Nine Mile Rd., Hazel Park, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
OK Tool Co., Milford, N. H.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

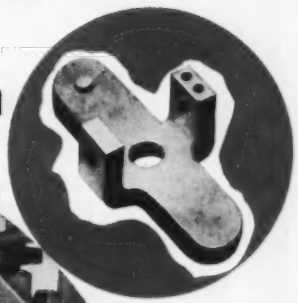
CUTTING AND GRINDING FLUIDS

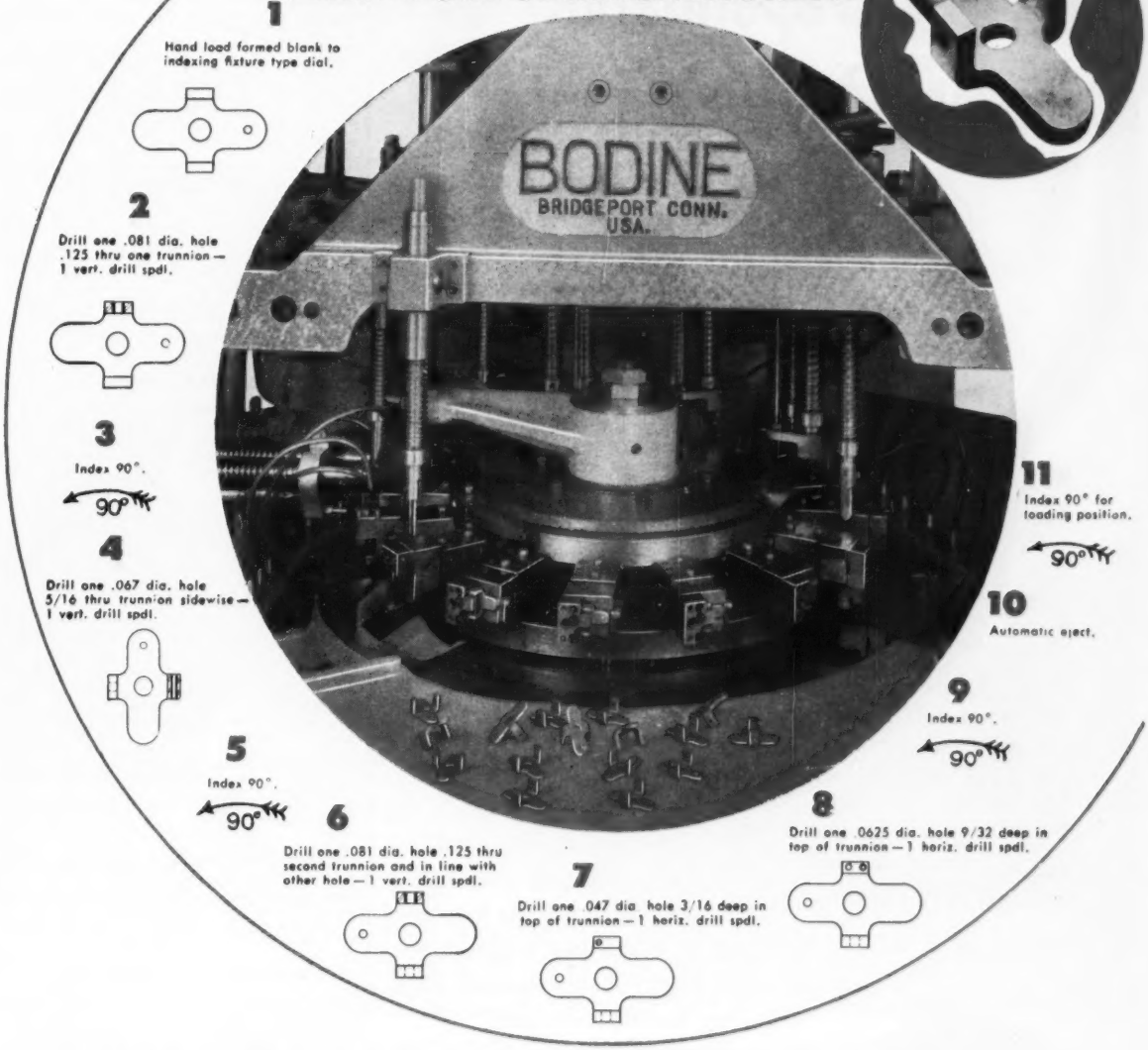
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.

(*Continued on page* 344)

Bodine CASE HISTORY NO. 34

PRODUCING A TELEPHONE ARMATURE OF MAGNETIC IRON




1
Hand load formed blank to indexing fixture type dial.
2
Drill one .081 dia. hole .125 thru one trunnion — 1 vert. drill spdl.
3
Index 90°.
90°
4
Drill one .067 dia. hole 5/16 thru trunnion sidewise — 1 vert. drill spdl.
5
Index 90°.
90°
6
Drill one .081 dia. hole .125 thru second trunnion and in line with other hole — 1 vert. drill spdl.
7
Drill one .047 dia. hole 3/16 deep in top of trunnion — 1 horiz. drill spdl.
8
Drill one .0625 dia. hole 9/32 deep in top of trunnion — 1 horiz. drill spdl.
9
Index 90°.
90°
10
Automatic eject.
11
Index 90° for loading position.
90°
BODINE
BRIDGEPORT CONN. USA.

PRODUCTION: The Bodine 42-30 automatic horizontal dial type of machine (one of 6 standard sizes) is equipped with 5 drill spindles (3 vertical, 2 horizontal) and special fixtures which automatically index the work 90° four times during the cycle. Production: 500 pieces (2500 operations) per 50-minute hour at 10 strokes per minute.

ACCURACY: *Alignment of two .081 dia. holes ±.002; other hole locations to within .010, hole diameters held to ±.002.*

WRITE FOR INFORMATION *on high-speed repetitive production with combinations of drilling, tapping, milling, screw inserting, staking, and assembly.*

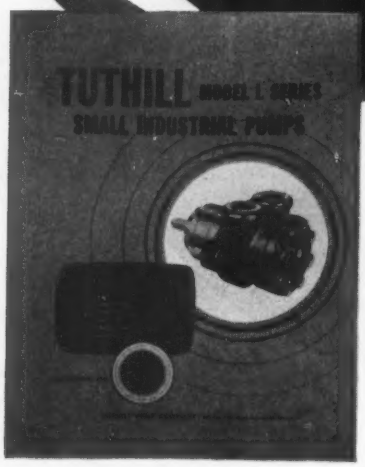
"You Can't Meet Tomorrow's Competition with Yesterday's Machine Tools."

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

For Dependable Pump Replacements!

GET THIS HELPFUL NEW GUIDE TO SMALL INDUSTRIAL PUMPS



The new Tuthill Catalog No. 101 on the Model L series of pumps presents the information you need to help you in selecting the right pumps for replacements on your equipment. It includes a special Pump Guide on Model L applications, plus complete specifications and performance data. Write for your copy of Catalog No. 101 today.

Tuthill Model L Pumps are designed for LUBRICATING, HYDRAULIC, TRANSFER, CIRCULATING and BURNING OILS SERVICE.

TUTHILL PUMPS FOR THE PURPOSE

TUTHILL PUMP COMPANY
Dependable Pumps since 1927
939 East 95th Street, Chicago 19, Ill.

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Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

CUTTING-OFF MACHINES
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).
Pines Engineering Co., Inc., Aurora, Ill.

CUTTING-OFF MACHINES, Abrasive Wheel
Campbell Mch. Div., American Chain & Cable, 929 Conn. Ave., Bridgeport, Conn.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.

CUTTING-OFF MACHINES, Cold Saw
See Sawing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.

CUTTING-OFF TOOLS
Aliegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CUTTING-OFF WHEELS, Abrasive
Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.

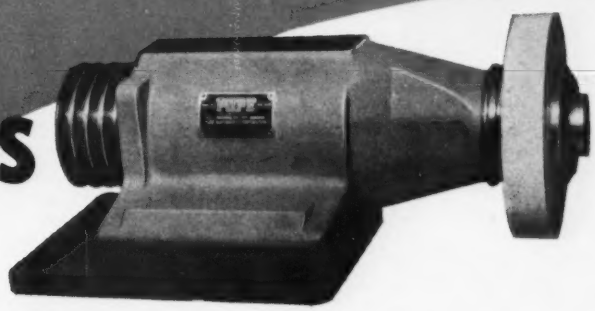
CYLINDERS, Air
Bellows Co., 230 W. Market St., Akron, Ohio.
Hannafin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic
Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.

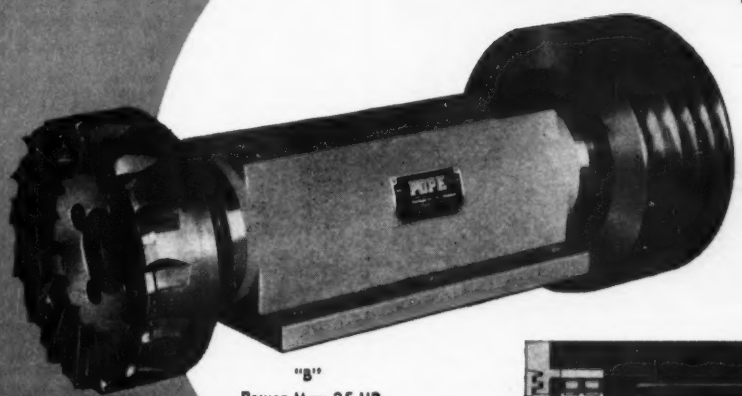
(*Continued on page* 346)

Specify POPE

HEAVY DUTY WHEEL HEADS



"A"

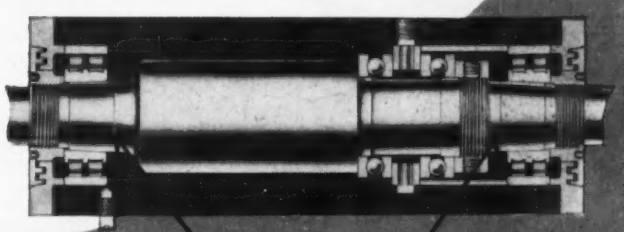


"B"
Power-Max 25 HP

Note the big precision bearings and the big shaft.

A pair of precision thrust bearings stabilize the shaft against any axial movement in either direction. (No end play)

The double row cylindrical roller bearings carry the radial loads with ease and at low temperature.



Taper mounting provides for precise individual preloading of the radial bearings.

Send us your specifications and ask for Catalog No. 59.

POPE Heavy Duty Wheel-Head Spindles are designed for a wide variety of applications such as grinding, boring, milling, drilling and many other operations requiring PRECISION COMBINED WITH RUGGEDNESS in the spindles.

For continuous production and trouble-free operation THERE'S NOTHING LIKE A POPE SPINDLE WITH ROLLER BEARINGS.

No. 94

Specify POPE® PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

KELLER Air Tools

for heavy production grinding

ANOTHER EXAMPLE OF
KELLER *Air Tools*
engineered to industry

Direct drive air motor

Light weight and balance

Low air consumption

Less fatiguing to operator

FACTS IN BRIEF
ABOUT KELLER PNEUMATIC GRINDERS

Keller Pneumatic Grinders combine great power with light weight . . . simplify the work of snagging castings, removing fins, dressing and polishing. Their spindles are specially hardened to reduce wear on the double-row bearings.

Keller Grinders have earned an enviable reputation for smooth operation through years of service. Governor maintains a constant speed that saves wear on grinding wheels.

Keller also makes die grinders and vertical grinders

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Keller Tool Company, Grand Haven, Mich.
Please send me a free copy of your booklet on Pneumatic Grinding and Cutting Tools

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Company_____

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National Forge & Ordance Co., Irvine, Warren County, Pa.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Oiigear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.

DEALERS, Machinery

Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die.

DIE-CASTING MACHINES

British Industries Corp., International Mchry. Div., 164 Duane St., New York, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

DIE CUSHIONS

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Wiliey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob Bros, Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

(*Continued on page* 348)

Only ONE can be called the Finest: Carlton

...here's another good reason why:

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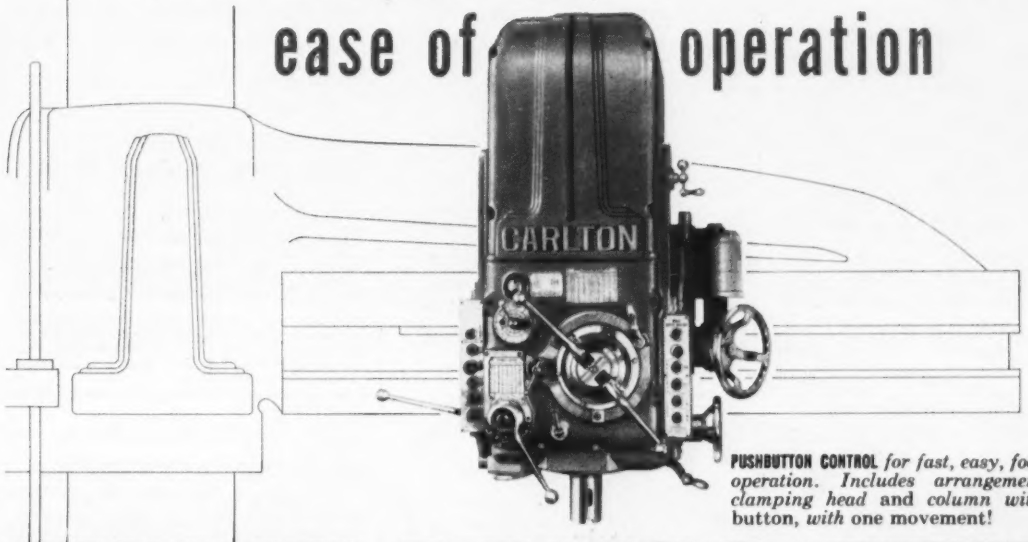
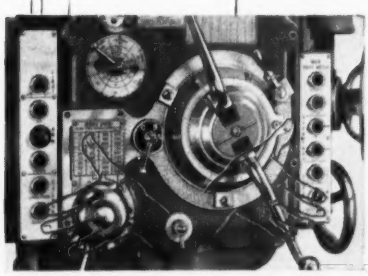
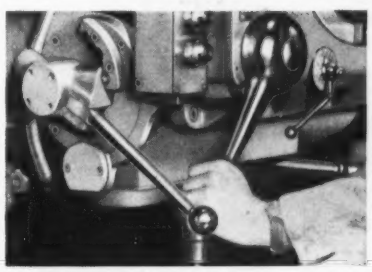


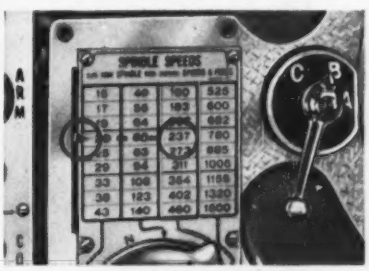
PUSHBUTTON CONTROL *for fast, easy, foolproof operation. Includes arrangement for clamping head* and *column with* one button, *with* one movement!



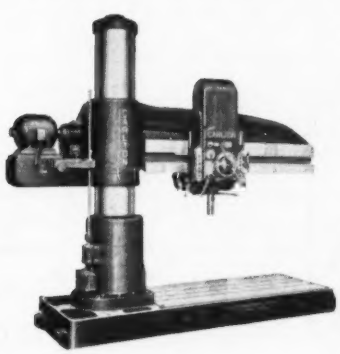
2-HAND CONTROL . . . *everything located within the arcs of a man's two hands. No groping. No fumbling. No lost motion . . . every move counts. Saves time and energy.*



2 LEVERS . . . *not three, but 2 levers control 36 spindle speeds. Simplified 2-lever control shortens machining cycle. More speeds mean wider range, more selectivity.*



SHIFT FROM DIRECT READING SPEED PLATE. *All 36 spindle speeds located instantly. No complicated 3-lever position charts to decipher. Spindle speed setting shown: 237 rpm.*



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No other radial drill can offer such easy, speedy operation.

No other radial drill can offer this combination of design, construction and operating advantages: pushbutton control, low hung drive, modern lubrication, 3-unit power clamping. There are many others, too numerous to mention here. Why not write us today for "the hole story." The Carlton Machine Tool Co., Cincinnati 25, Ohio.

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2. Longer plate life since clutch never needs adjusting, always exerts full design torque.
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Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.

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American Steel Foundries, Eimes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc,. 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS

See Stocks, Die.

DIES, Lettering and Embossing

Hoggson & Pettis Mfg. Co., 149 Brewery St., New Haven, Conn.

DIES, Sheet Metal, Etc.

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Bath, Cyril, Co., 6984 Machinary Ave., Cleveland 3, Ohio.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Mullins Manufacturing Corp., Salem, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading

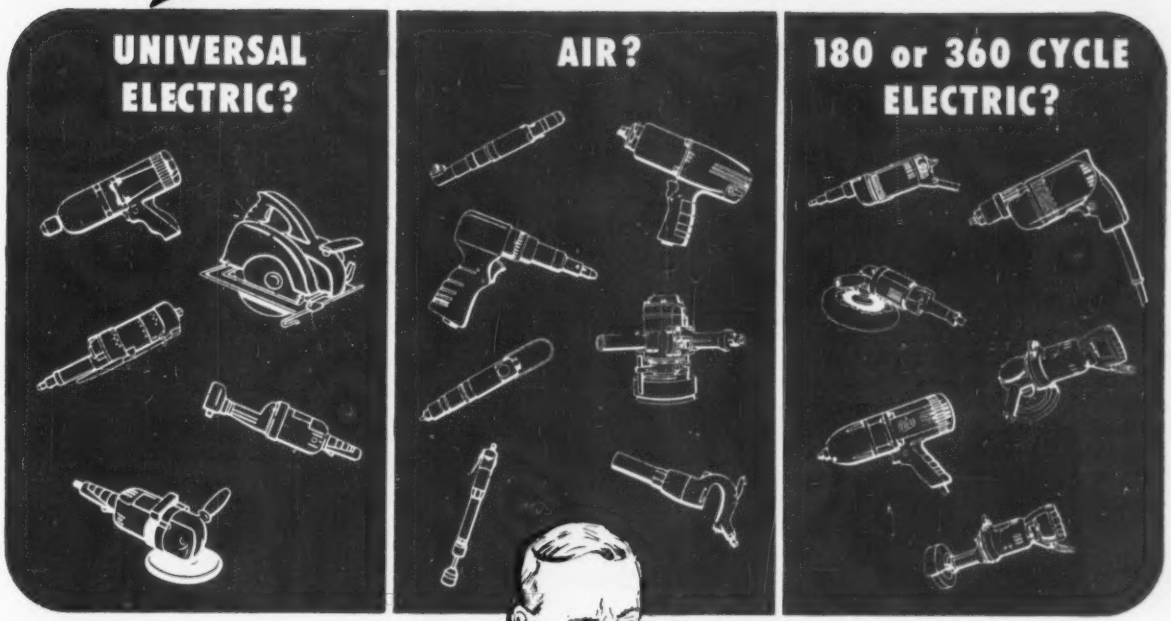
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Detroit Tap & Tool Co., Detroit, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

(*Continued on page* 350)

Thor HAS THE ANSWERS!



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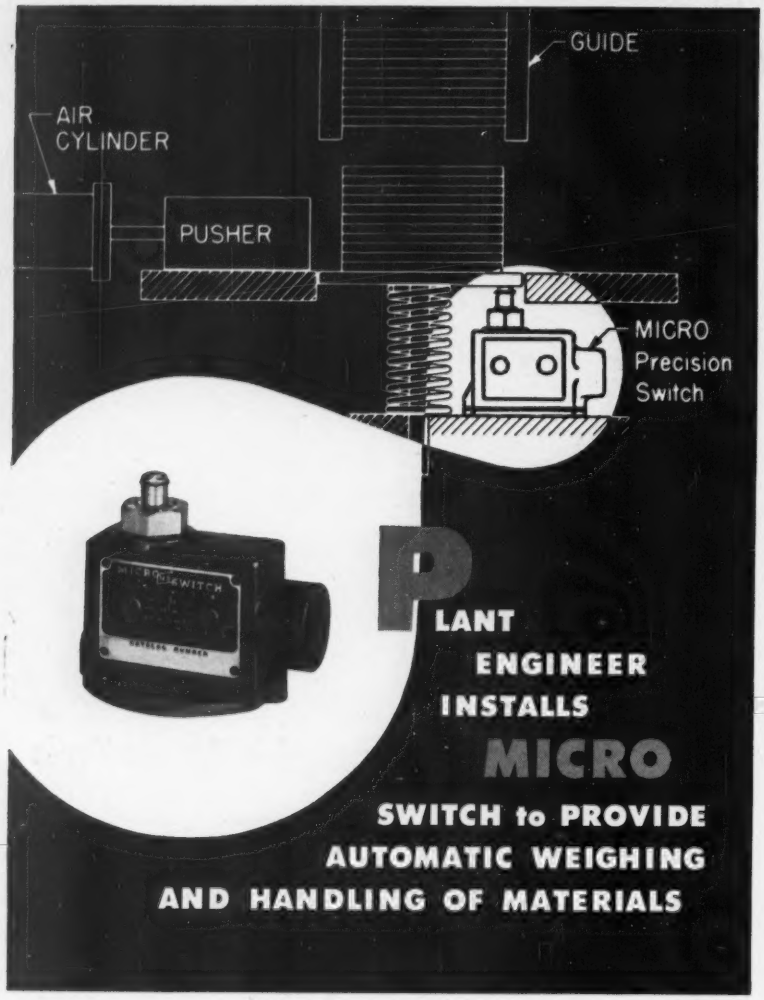

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DISINTEGRATORS

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Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

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Universal Drafting Mch. Corp., 7960 Lorain Ave., Cleveland, Ohio.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio
Meyers, W. F., Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.

DRIFTS, Drill

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Govro-Nelson Co., 1933 Antoinette St., Detroit 8, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
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(*Continued on page* 352)

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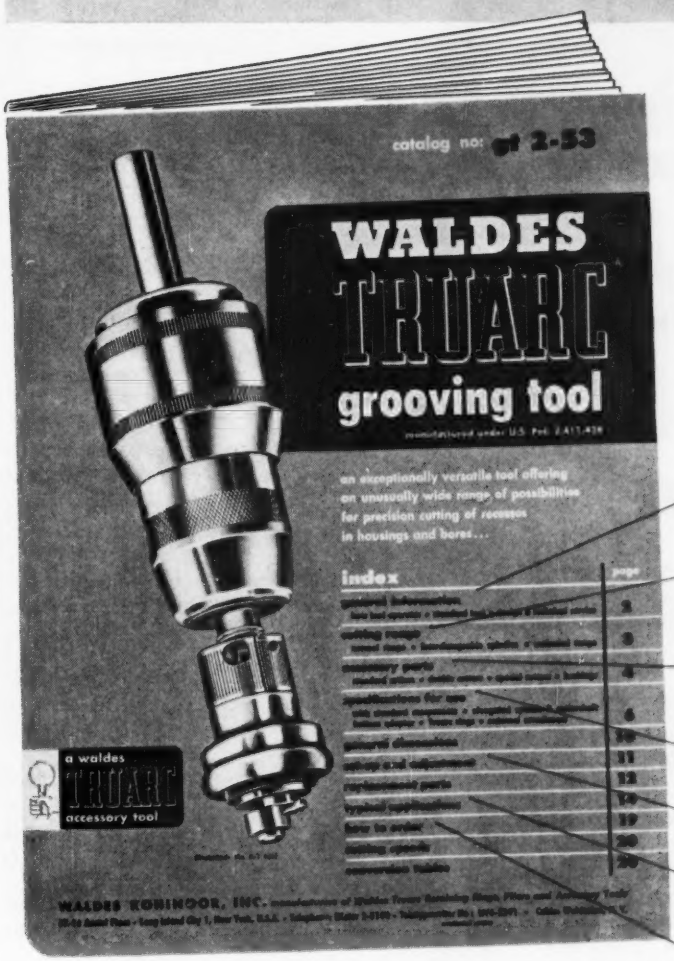

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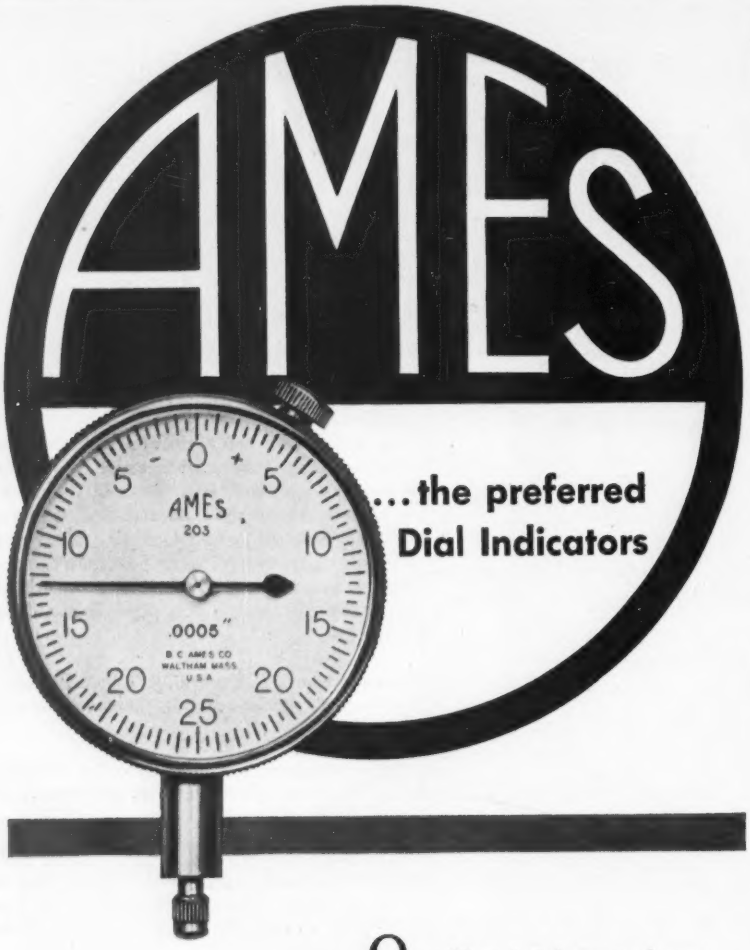

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Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
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Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
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Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
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Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

DRILLING MACHINES, Boiler

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(*Continued on page* 354)

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. . . and ALLEN ⬡ SOCKETS have the strength to make this new type practical

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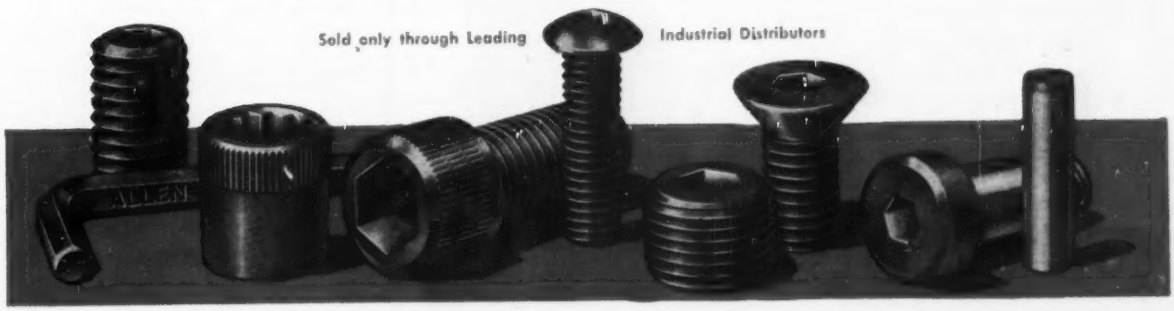

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Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
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Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K. Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

DRILLING MACHINES, Horizontal Duplex

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Center Column Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

DRILLING MACHINES, Multiple Spindle

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mich. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
British Industries Corp., International Mchry. Div., 164 Duane St., New York, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang.

DRILLING MACHINES, Sensitive

Buffalo Forge Co., 490 Broadway, Buffalo, N.Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
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Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N.Y.
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(*Continued on page* 356)

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Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
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Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Wall Radial

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
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Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

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Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.

(*Continued on page* 358)

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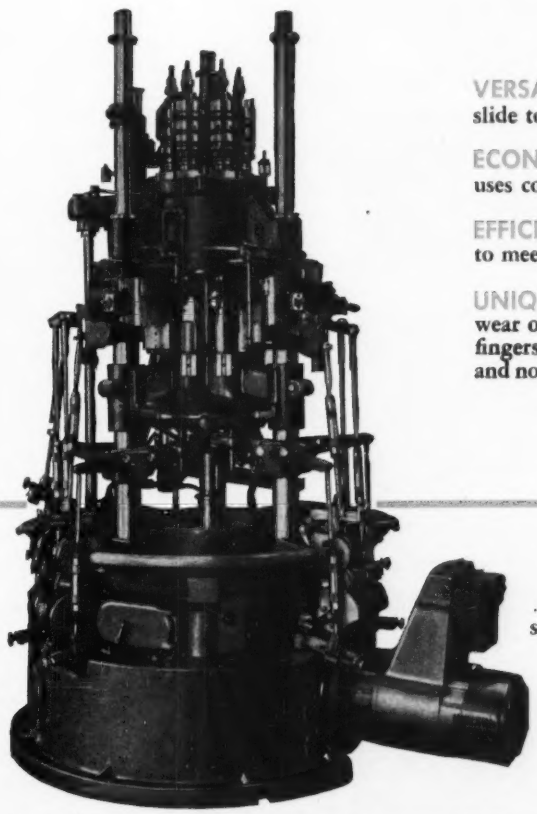
THE IMPROVED 6-SPINDLE PRECISION AUTOMATIC LATHE



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(Shown without bar carrier and oil guards)

VERSATILE— SIX rotating end tools and SIX cross slide tools.

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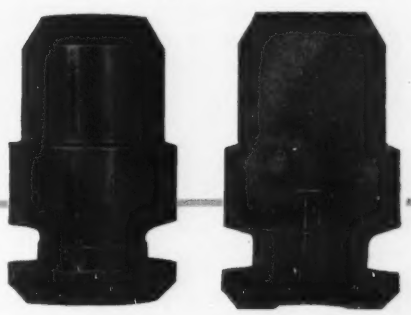
. . . can also be performed to great advantage. Vertical design permits easier loading and holding of work pieces.

Typical work piece taken from bars; capacity of 2⅝" dia. and 6" long.



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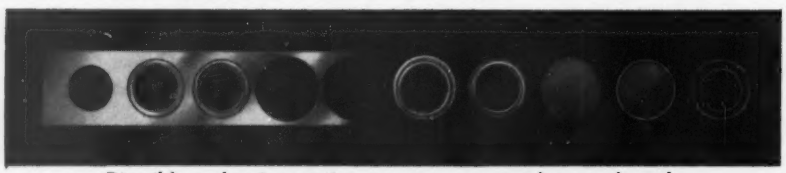

Die ribbon showing stations necessary to produce each seal.

SOLUTION: B. JAHN PROGRESSIVE DIES *Production Proved* to turn out *50 complete units per minute!* All seals were identical — all were perfect. Tools were so designed that with a 3 hour set-up time for each, 9 different sized seals could be produced in the same press equipment.

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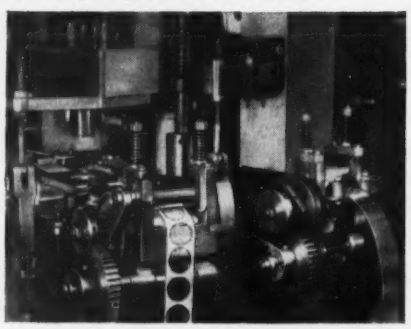

Ball bearing die during pre-test run on customers' equipment. First step of exhaustive tests before die is certified "PRODUCTION PROVED."

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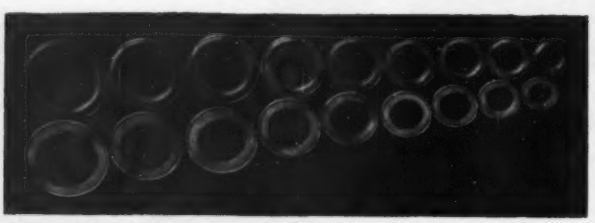

Top and bottom views of nine different seal assemblies.

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Bellows Co., 230 W. Market St., Akron, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Besly-Welles Corp., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
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Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
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National Twist Drill & Tool Co., Rochester, Mich.
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EMERY WHEELS

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(*Continued on page* 360)

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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
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Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

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See Couplings, Flexible.
(*Continued on page* 362)

need a better finish?

Torrington Swaging Machines – delivering 4000 hammer blows a minute – work out surface imperfections quickly... produce a finish far superior to that obtained by other reduction methods. Swaging improves the quality of the material, too, and utilizes every ounce of stock.

"The Torrington Swaging Machine" describes all the advantages of swaging and gives full details on all Torrington machines. A copy is yours for the asking.

THE TORRINGTON COMPANY
Swager Department
558 Field Street • Torrington, Conn.
Makers of
TORRINGTON NEEDLE BEARINGS

In hydraulic pumps

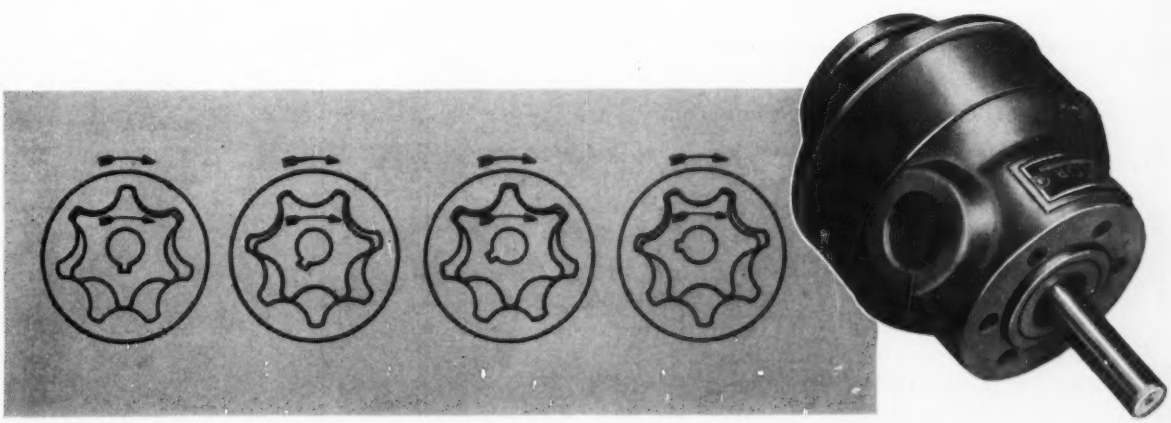
GEROTOR

is more than a name . . .

it's the principle of the thing!

The unique Gerotor principle operates with high volumetric and mechanical efficiency. Both gear-shaped Gerotor elements revolve in the same direction at low relative speed, resulting in less wear, longer life. Continuous fluid-tight engagement means less slippage, more uniform flow. See relative advance of teeth and spaces below.

Gerotor hydraulic pumps are engineered for pressures up to 1000 p.s.i. continuous duty; in some sizes, up to 1200 p.s.i. continuous and 1500 intermittent. Deliveries range from .4 g.p.m. at 1800 r.p.m. to 40 g.p.m. at 1200 r.p.m. Plain, base or flange mounting. Write for pump catalog.
GEROTOR MAY CORP., P. O. Box 86, Baltimore 3, Md.



GEROTOR hydraulic pumps & motors

Rolling with the Punches..

Drum segment assembly, 17½" dia. x 46" long—rough, sandy steel forging. Note the many interrupting cavities on the surface that give the tool its bumps.

On the jump cut job illustrated, a Kennametal clamped-tool is a 6 to 1 favorite over a HSS tool . . . takes thousands of bruising blows on its nose without breaking down; cuts miles of forged, sandy steel without wearing out.

Here are the comparative performances:

HSS tools took 12 hours to complete 2 cuts, and were reground 4 to 8 times. Kennametal tool Style BRH32, Grade K2S, operating at 6 times the speed, does the same work in 2 hours. Its clamped-on tip requires only 2 regrinds.

Great strength and ruggedness are required in a cutting tool, to enable a lathe to keep rolling on interrupted cutting. These qualities, inherent in Kennametal tools, are equally valuable for light, continuous cutting jobs. Ask our Field Engineers to demonstrate. Kennametal Inc., Latrobe, Pa.

KENNAMETAL
CEMENTED CARBIDE TOOLING
THAT INCREASES PRODUCTIVITY

FLEXIBLE SHAFT EQUIPMENT
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Jarvis, Chas. L., Co., Middletown, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGING (Upsetting) MACHINES
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Baldwin-Lima-Hamilton Corp, Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.

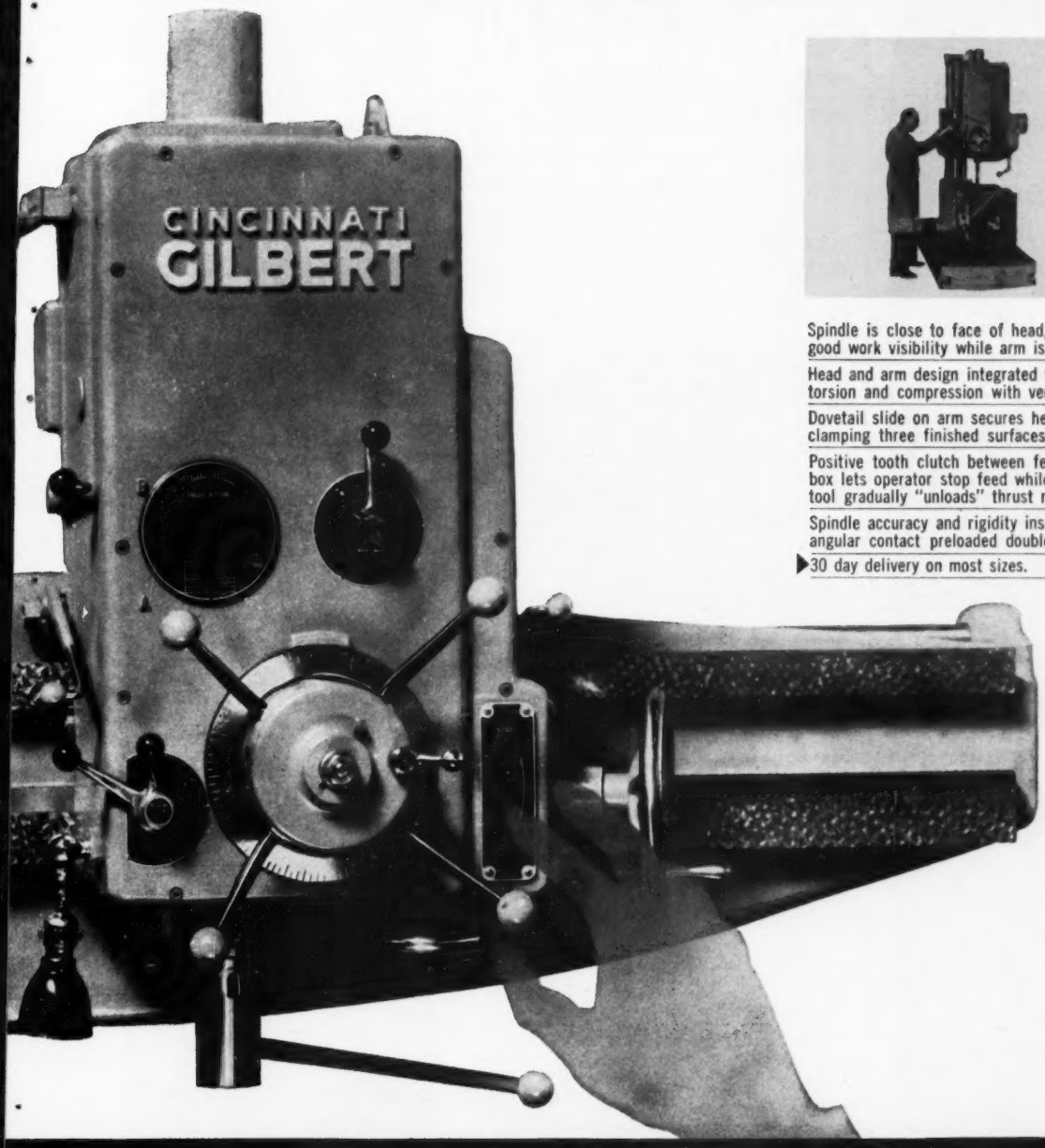
FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg, Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif. (Stretch-Wrap).
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

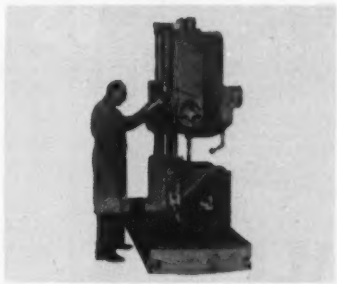
FORMING AND STAMPING MACHINES
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co, Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

FORMING TOOLS or Tool Blanks
Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

(*Continued on page* 364)

MOVES FAST: STAYS PUT





Spindle is close to face of head, provides good work visibility while arm is low.

Head and arm design integrated to withstand torsion and compression with very low deflection.

Dovetail slide on arm secures head by clamping three finished surfaces together.

Positive tooth clutch between feed worm and gear box lets operator stop feed while spindle turns and tool gradually "unloads" thrust normally absorbed by arm.

Spindle accuracy and rigidity insured by four angular contact preloaded double zero ball bearings.

▶30 day delivery on most sizes.

Fast response to all controls with minimum effort, plus positive "no-drift" clamping, make it easy for Cincinnati Gilbert operators to get more work done accurately and on time. No one detail is responsible; it's the combination of "clean" design and rugged construction that makes Gilberts consistently pay high returns on your investment. 9" and 11" columns. Ask your Gilbert representative to demonstrate why "those who buy Gilbert buy Gilbert again."

GILBERT

THE CINCINNATI GILBERT MACHINE TOOL COMPANY • 3366 BEEKMAN STREET, CINCINNATI 23, OHIO

cut power blade costs at least 15% with

VICTOR "Moly"® Blades

Yes, that's right—when you order VICTOR Moly Power Blades from your Distributor, you cut your initial blade cost 15%, and you'll get extra economies through faster, more efficient cutting and longer blade life.

Over the years, *quality* has made VICTOR Blades the blades industry prefers.

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For VICTOR Blades—as well as hundreds of other products you regularly buy—your Industrial Distributor is the man to call. He is close to your problems. He gives you fast service. He has the assistance of trained factory representatives in solving many of your every day production problems. Buy all you can from him.

VICTOR Hand and Power Hack Saw Blades Are Sold Only Through Recognized Distributors.

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SAW WORKS, INC. • MIDDLETOWN, N. Y., U. S. A.

Makers of Hand and Power Hack Saw Blades, Frames and Metal Cutting Band Saw Blades

1824

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FURNACES, Heat-Treating
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio

GAGE BLOCKS
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Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

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GAGES, Comparator
Alina Corp., 401 Broadway, New York 13, N.Y.
Ames, B. C., Co., Waltham 54, Mass.
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DoAll Co, 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
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Standard Gage Co., Inc., Poughkeepsie, N. Y.
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Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
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Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
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Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Height
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

(*Continued on page* 368)

"IT'S THE GREASE FOR TOUGH OPERATIONS"

says McCULLOCH MOTORS CORP.
Makers of the famous McCulloch Chain Saws

"We tested all types and makes of lubricants for the Zerol gears in the transmission. The one grease selected for long, tough operation was LUBRIPLATE. Now that we have produced thousands of McCulloch Chain Saws, we more than ever recommend the use of LUBRIPLATE Lubricants in our tools."

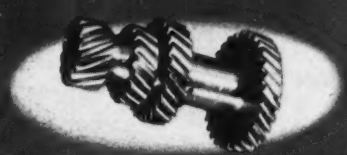
For nearest LUBRIPLATE distributor, see Classified Telephone Directory. Send for free 56-page "LUBRIPLATE DATA BOOK"... a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

GEARS SHAVED in 12 to 20 SECONDS

Finishing precision gears to close tolerances on tooth profile, index, eccentricity and tooth surface smoothness on Red Ring Shaving Machines is a high production operation as indicated by these random examples.

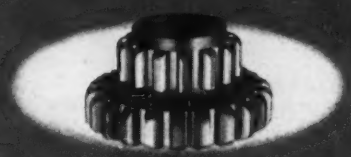
A SHAVING TIME 16 SECONDS



B SHAVING TIME 16 SECONDS

C SHAVING TIME 20 SECONDS

D SHAVING TIME 12 SECONDS



E SHAVING TIME 15 SECONDS

F SHAVING TIME 20 SECONDS

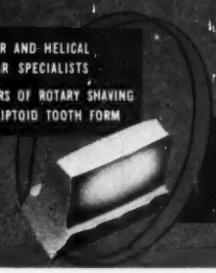
GEAR CHARACTERISTICS

Gear	Stock Removed Over Pins	Material	No. of Teeth	PD	DP	Face Width
A	.010"	Steel	19	2.4"	9.25	5/8"
B	.010"	Steel	29	4.00	9.25	11/16"
C	.010"	Cast Iron	28	2 3/4"	10	1 1/16"
D	.005"	Steel	12	1 1/8"	13.5	1"
E	.006"	Steel	14	2 1/4"	6/8	1 1/4"
F	.012"	Aluminum	54	5 7/8"	10	7/8"

WRITE FOR DESCRIPTIVE LITERATURE ON *Red Ring Gear Shaving*

SPUR AND HELICAL GEAR SPECIALISTS

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM



NATIONAL BROACH & MACHINE CO.

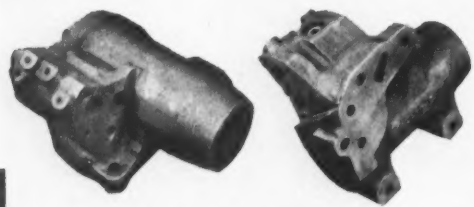
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

TRACTOR ENGINE PLANT

Speeds-Up Production with...

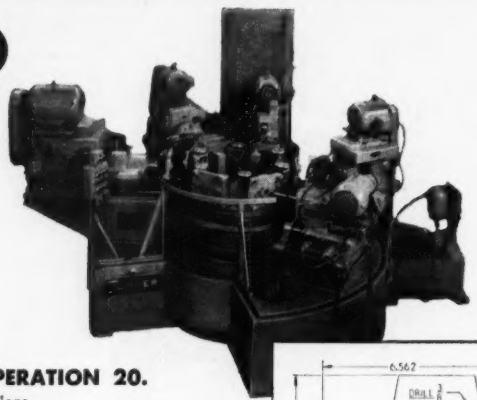
Five Turner special purpose machines perform *55 operations* to produce 80 hydraulic lift cylinders per hour at 80% efficiency per machine.

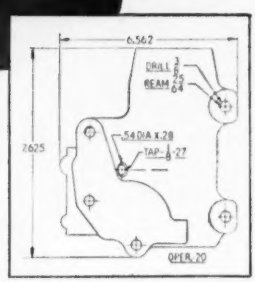


In designing and building these special automatic indexing-type machines, Turner has solved a difficult problem of producing hydraulic lift cylinders at high speed, with maximum efficiency, yet at a low manufacturing cost. It was done by employing time and money-saving Turner manufacturing methods. For example, on Operation 90, Turner designed multiple spindle heads are used for drilling, reaming, counterboring, chamfering, spot-facing and tapping. Two castings in each fixture are machined at the same time in a two cycle operation, so that at the end of the first two cycles, a finished machined part comes off the table with each cycle thereafter. Where deep holes are needed, there is no time lag taken up by repeated passes of the drill. The work piece is indexed to a second and third station for completing deep drilling and equalizing the other operations. It insures uninterrupted machining at all stations at the same time. Follow the five illustrations for detailed sequence of operation of each machine.

Turner solves high production problems such as this by first studying the problem thoroughly, applying years of technical experience; then, by designing fixtures and spindle heads *exactly suited to your job.* With all of the Turner special purpose machines, standard bases and columns are used. This keeps manufacturing costs at a minimum. It means you are assured a machine specially designed for your application, yet without the high extra costs you might expect.

1





OPERATION 20.

Stations

No. 1 Load and Unload

No. 2 Drill (5) ⅜ hole

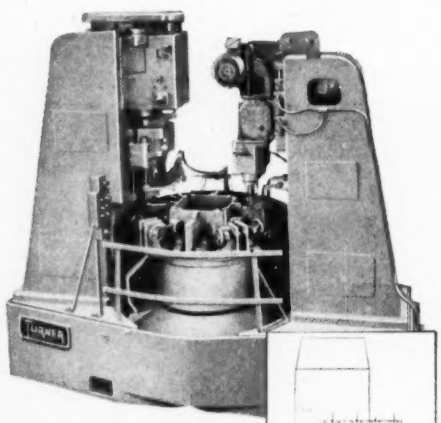
No. 3 Ream (5) 25/64 holes

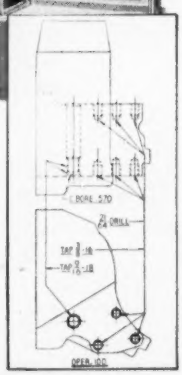
No. 4 End Drill .54 diameter x .28 counterbore

No. 5 Drill (1) 21/64 hole ¼ deep for counterbore

No. 6 Tap ⅛ x 27 pipe thread

4





OPERATION 100.

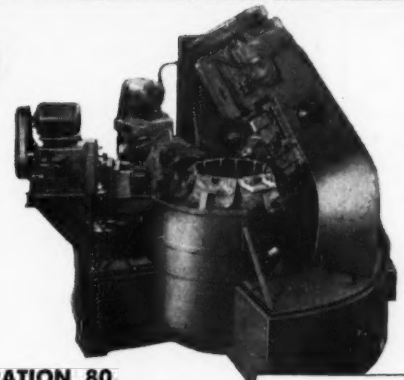
Stations

No. 1 Load and unload and transfer to other side of fixture.

No. 2 Tap drill (6) ⅜ x 16 holes. Combination ream ½ diameter and counterbore .565-.570 x .09 deep.

No. 3 Tap (6) ⅜ x 16 holes and (1) ⅝ x 18 hole.

TURNER Special Automatic Indexing-Type Machines!



OPERATION 80.

Stations

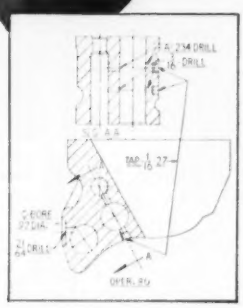
No. 1 Unload and transfer to other side of fixture

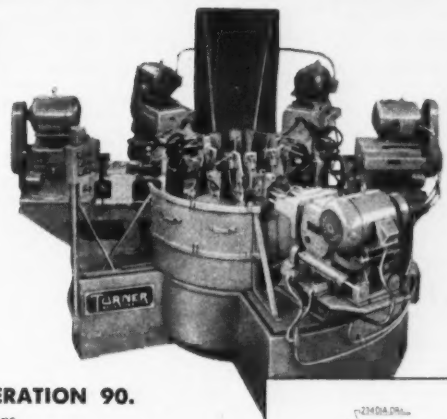
No. 2 Drill (1) "A" diameter hole through into 1.0002 bore, Step Drill (1) "A" diameter tap hole and 3/16 diameter into 1.0002 bore.

No. 3 Drill (1) "A" and (1) 3/16 diameter into .6865 hole.

No. 4 Tap (2) 1/16 x 27 dryseal pipe tap

No. 5 Drill 21/64 diameter x .75 deep and counterbore .92 diameter x .72 deep.





OPERATION 90.

Stations

No. 1 Unload and transfer to other side of fixture.

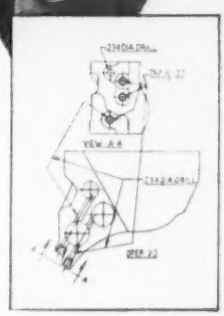
No. 2 Drill (4) .234 holes at bottom of (4) 1" holes through plug guide bushings.

No. 3 Spot face (4) 3/16 x .234 dia.

No. 4 Drill (4) .234 holes.

No. 5 Drill (1) .234 hole into .6873 hole.

No. 6 Tap 1/16 x 27 pipe tap (3) holes.



OPERATION 110.

Stations

No. 1 Load and Unload

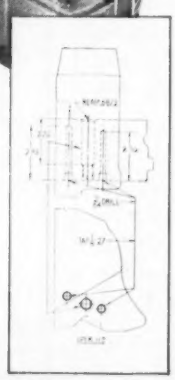
No. 2 Drill .234 diameter hole first step and drill 21/64 diameter hole first step.

No. 3 Drill .234 diameter hole and 21/64 diameter hole second step.

No. 4 Finish drill .234 and 21/64 holes.

No. 5 Tap 1/8" pipe tap and tap 1/16" pipe tap.

No. 6 Ream .6865-.6873 diameter.



You'll find other Turner special purpose machines designed to meet difficult assembling and testing jobs, too; or, wherever special hydraulic presses, impregnating and flushing machines are needed to perform a tough job in the shortest possible time. Turner special automatic indexing-type machines are available from 2 to 36 stations in diameters up to 12 feet.

If you have a production assembly or inspection problem where you can use to advantage a special purpose machine, write today describing your problem. After our engineering department analyzes it, our field engineer will discuss it with you.

TURNER BROS. INC.

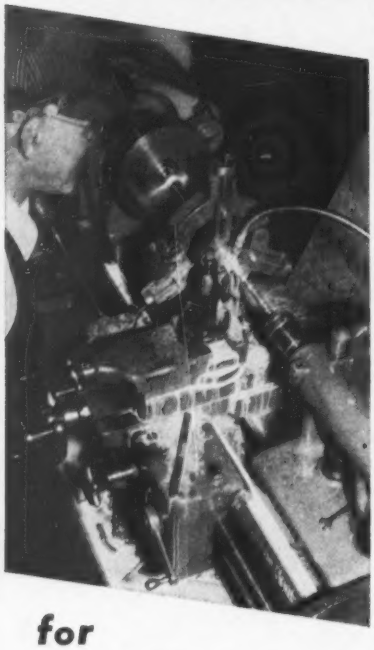
2625 HILTON ROAD
FERNDALE 20, MICHIGAN

DESIGNERS and BUILDERS of:

- SPECIAL MACHINES
- JIGS and FIXTURES

TURNER BROTHERS

SOUTH BEND 14½" LATHES



for

FAST, PRECISION MACHINING

South Bend 14-1/2" Lathes offer many advantages for precision machining. Ease of operation, speed, power, accuracy, and efficiency are some of the features responsible for their popularity. Often the precision and quality of finish obtained with South Bend Lathes are such that subsequent grinding, honing, or lapping operations are unnecessary. Substantial savings in capital investment, power consumption, floor space, and labor costs have resulted from their installation.

Write for catalog on 14-1/2" lathes. Also, 9" to 16-24" Lathes, 7" Bench Shapers and 14" Drill Presses.

SPECIFICATIONS

Swing — 14⅛" over bed and saddle wings
Center Distances — 24½" to 60½"
Collet Capacity — 1"
Spindle Speeds — 8, 30 to 875 r.p.m.
Power Longitudinal Feeds — 48 R.H. or L.H., .0015" to .0841"
Power Cross Feeds — 48, .0006" to .0315"
Thread Cutting — 48 R.H. or L.H. pitches, 4 to 224 per inch

SOUTH BEND LATHE
SOUTH BEND 22, INDIANA
Building Better Tools Since 1906

SOUTH BEND LATHES

GAGES, Plug, Ring and Snap

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GAGES, Surface

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ennis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., Detroit, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engineering Co., 14228 Birwood, Detroit 4, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

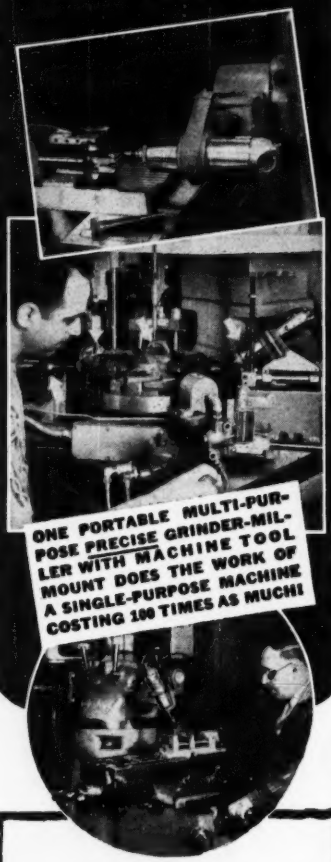
GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.

(*Continued on page 370*)

LOWEST COST PRECISION

FOR TOOL ROOM AND PRODUCTION



ONE PORTABLE MULTI-PURPOSE PRECISE GRINDER-MILLER WITH MACHINE TOOL MOUNT DOES THE WORK OF A SINGLE-PURPOSE MACHINE COSTING 100 TIMES AS MUCH!

Little can be done today to reduce labor and material costs. For substantial savings employ new, better techniques. Mount PRECISE Grinder-Millers on lathes, drill presses, milling machines and other machine tools or use in special production set-ups. ¼ HP, speeds from 20,000 to 45,000 r.p.m.; 115 volts, AC-DC. Ruggedly built for continuous duty. All metal housing, rigid PRECISE quill; sealed micro-precision bearings. *High speeds and accurate PRECISE quill and chuck are ideal for tungsten carbide cutters.* PRECISE will grind, mill or finish any material from soft wood to the hardest alloy steel.

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Precise

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ANOTHER
COMPLEX
DRILLING PROBLEM

SOLVED

by

with a BAKER SPECIAL MACHINE

Baker Multi-Operation Machine utilizing standard Baker 7½ x 16 and 15 x 16 units and a 72" six-station power indexing table, performs drilling, chamfering, boring, counterboring, and tapping operations on clutch housings at the rate of 80 parts-per-hour at 100% efficiency.

STATION No. 1
LOAD and UNLOAD

STATION No. 2
VERTICAL UNIT
No. F Drill thru 2 holes .257
Drill thru 1 hole 15/32
Drill thru 5 holes 13/32
Drill thru 2 holes 25/64
Drill thru 3 holes "U" (.368)
HORIZONTAL UNIT
F Drill thru 8 holes
Mill Pad

STATION No. 3
VERTICAL UNIT
2 holes ⅜ dia. x 90° chamfer
3 holes ½ dia. x 90° chamfer
2 holes spotface 1⅜ dia.
HORIZONTAL ANGLE UNIT
2 holes 15/32 drill
1 hole F (.257) drill

STATION No. 4
VERTICAL UNIT
2 holes .438/.499 dia. ream
1 hole semi finish center bore
1 hole comb semi finish and finish starter bore
HORIZONTAL UNIT
8 holes ⅛ dia. & 90° chamfer

STATION No. 5
VERTICAL UNIT
Comb. 15/16 drill & 1/16 x 45°. Chamfer 2 holes. Rough bore center bore 1 hole. Rough bore starter bore 1 hole.

STATION No. 6
VERTICAL UNIT
3 holes 7/16—14 tap
2 holes 5/16—18 tap
HORIZONTAL UNIT
8 holes 5/16—18 tap

Baker Special Drilling Machines, composed of standard Baker units arranged to suit each individual problem, are designed for *productivity*. Units arranged in vertical, horizontal and angular planes perform multiple operations *faster . . .better . . . automatically* . . . with greater accuracy and efficiency. Consult Baker engineers for a better solution to your drilling problems.

. . SINCE 1867

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DRILLING . . . TAPPING . . . KEYSEATING and CONTOUR GRINDING MACHINES

Fellows Gear Shaper Co, 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Michigan Tool Co., 7173 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave. Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

American Stock Gear Div., Perfection Gear Co., Harvey, Ill.
Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

(*Continued on page* 372)

FRAY VERSATILITY
MOVES WORK FASTER!
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UNIVERSAL RAM • TURRET TYPE •
VERTICAL & HORIZONTAL
MILLING MACHINE
Speed up production by cutting job transfers with the versatile Fray 10-RH. This all-purpose milling machine performs an unequalled range of operations, cuts idle machine time and produces more work per man hour. It machines at any angle—vertical, horizontal or both. It mills, drills or bores at any angle. On any single piece of precision work requiring a variety of operations it is easier to reset the Fray than to transfer the work. For faster jobs, done better at less cost—investigate the easy to operate Fray 10-RH. A High Precision Tool.
FRAY "ALL-ANGLE" HEAD TYPE 4
For deep, heavy cuts. Permits working to extra close limits. Any angle up to compound 2-way. Request Bulletin 4.
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Rapid-Fire . . . Accurate . . . Dependable SHELL FORGING calls for H-P-Ms!

Piercing, bottoming, drawing, nosing and living up to strict governmental production requirements are all in a day's work for H-P-M shell forging installations like this one at J. B. Beaird Company, Inc., Shreveport, Louisiana.

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Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Erie Ave. and G St. Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave. Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

American Stock Gear Div., Perfection Gear Co., Harvey, Ill.
Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GOGGLES

American Optical Co., Southbridge, Mass.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

GRINDERS, Carbide Tool

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Bellows Co., 230 W. Market St., Akron, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool

GRINDERS, Portable Electric and Toolpost

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool

GRINDING FIXTURES

Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.

(*Continued on page 374*)

self releasing
precision expanding mandrels

.0005" ACCURACY GUARANTEED

ERICKSON PRECISION EXPANDING MANDRELS provide the ideal means of gripping on interior surfaces. With them, close tolerance machining or checking operations can be accomplished with exceptional speed.

The mandrel sleeve, alternately slotted from each end, expands and grips along its entire length . . . accommodates variations over 1/32" range.

A single mandrel shank is usable with an entire series of sleeves and can handle an enormous variety of work.

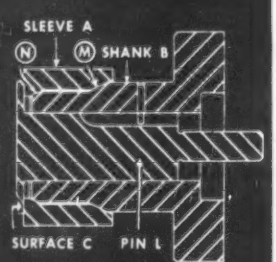
Besides the illustrated standard models, multiple sleeve and other special designs can be adapted to meet specific job requirements.

Sleeves can be machined to fit splines, undercuts, threads, and other internal contours.

A-7610

the inside story...

Sleeve "A" is automatically lined up concentrically with the axis of shank "B" by the sleeve's cam surfaces "M" and "N". These mate with the cam surfaces of the shank to within .0001". Sleeve "A" is open slotted at both ends. When pin "L" is drawn back against surface "C", sleeve "A" expands equally over its entire length. Release of this force instantly relieves the mandrel's grip. Some models use locknuts to expand the sleeve instead of the drawpin in the diagramed design.



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...with TYCOL lubricants on hand!

Heavy-duty cutting operations? Here's what happens when you switch to Tycol Afton oils! A well-known Engineering Company (you'd recognize the name instantly) recently tested cutting oils used to shape 14" gears on a Gleason Bevel Gear Generator. Their findings: after the first rough cut around, with competitive oils, they had to grind a full ⅛" off the cutter. With Tycol Afton 8, they hobbed *two* gears and took off only .013". Afton oils are non-corrosive . . . and so stable they're widely recommended as hydraulic oils! They serve a triple function as coolants, lubricants, and hydraulic media on the same machine . . . the heavier the cut — the better they perform. It will pay you to find out why — by contacting your local Tide Water office!

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America's high standard of living is the direct result of increased productivity through better tools and better methods.

Independent production engineering firms are the way to even higher standards.

Design, tooling and methods specialists, they increase productivity and cut costs in all phases of manufacturing.

With Pioneer as their leader, they are improving our standard of living through efficient and dependable engineering when and where needed.

They can help you, too.

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Detroit 3, Michigan

Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Besly-Welles Corp., Beloit, Wis.
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, Geo., Mich. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

GRINDING MACHINES, Broach

Colonial Broach Co., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Diversified Metal Products Co., 5125 Alcoa Ave., Los Angeles 58, Calif.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Inc., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GRINDING MACHINES, Chucking

Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Dumore Co., 1300 17th St., Racine, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

(*Continued on page* 376)

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develops efficient production methods, including automation, plant layout, materials handling, etc...

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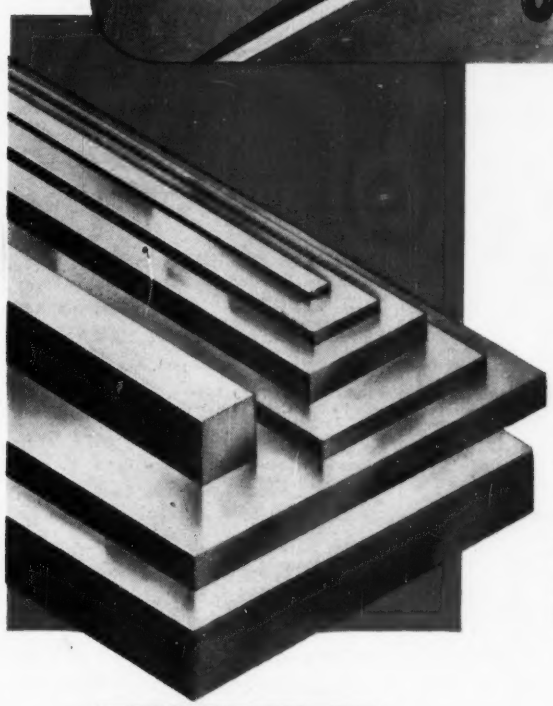

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The Ready-to-Use Steel of 1001 Uses!

Simonds offers you a choice of OIL or AIR Hardening DIE STEEL, whichever is best suited to your requirements. Both types are made from Simonds own steel, are precision ground to a thickness limit of plus or minus .001" and have an extra smooth surface finish of 25 to 35 micro inches. Edges and ends are square and parallel, with all scale, decarburation and surface defects removed. All sizes come individually packaged with heat treating instructions.

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(non-deforming 5% Chrome Type) is spherodize annealed for good machinability and uniform hardenability. Its wide hardening range (1700° to 1800° F.) makes it practically foolproof in heat-treating. Stock sizes run from ½" to 2" thick and 2" to 10" wide in 36" lengths.

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Canadian Factory in Montreal, Que.
Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada

GRINDING MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Drill

Blake, Edward, Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Besly-Welles Corp., Beloit, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment.

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines.

GRINDING MACHINES, For Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
British Industries Corp., 164 Duane St., New York, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Schutte, Alfred H., Koln-Deutz, Germany
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

GRINDING MACHINES, Jig

Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

(*Continued on page* 378)

ARTER *Precision*

ROTARY SURFACE GRINDERS
for Jet and Piston Engine Airplane Parts

THE MODEL "A"

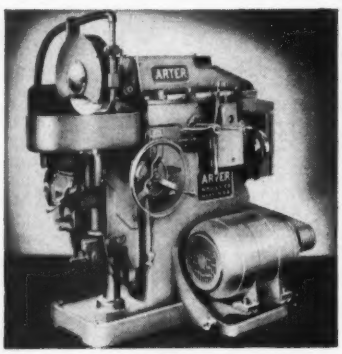
Model "A". Grinding is done on the periphery of the wheel, the work being held by a rotating magnetic chuck. Two sizes: 8" and 12" diameter.

THE MODEL "B"

Model "B". Four chuck capacities — 20", 24", 30" and 40". These machines are mainly hydraulically operated. Great vertical capacity. Work table can be tilted.

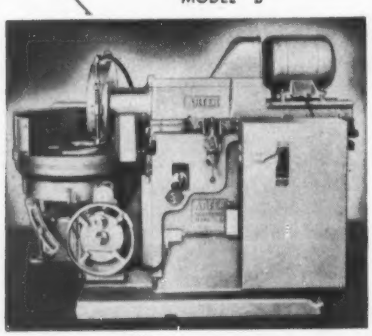
THE MODEL "D"

Model "D" — two chuck capacities — 12" and 16". A 7½ h. p. motor, precision balanced, mounted on the wheel slide delivers full power by multiple vee belts, to the wheel spindle.

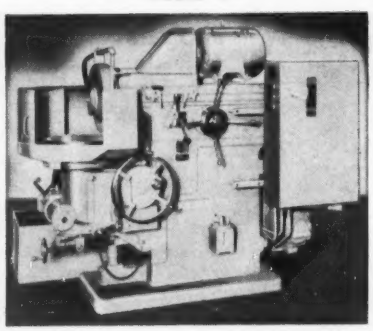


MODEL "A"

MODEL "B"



MODEL "D"



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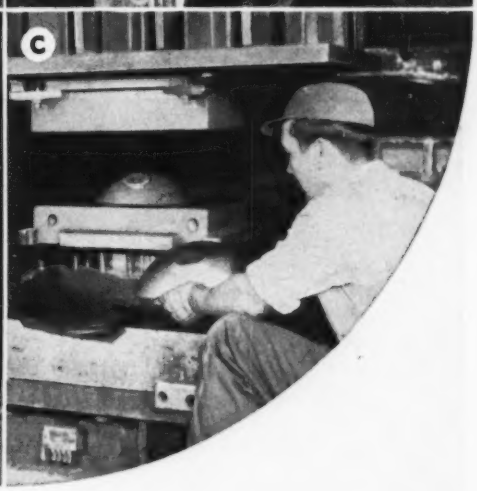

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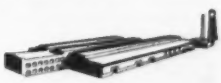
PLANT 1
Detroit, Mich.

PLANT 2
Detroit, Mich.

PLANT 3
Hillsdale, Mich.



PLANT 4
Hillsdale, Mich.

GRINDING MACHINES, Profile

Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Radial, Ball Race, Etc.

Besly-Welles Corp., Beloit, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co.

GRINDING MACHINES, Radius, Link

Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Ring Wheel

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

Van Norman Co.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
British Industries Corp., International Machinery Div., 164 Duane St., New York, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gollmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Thor Power Tool Co., Aurora, Ill.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Dumore Co., 1300 17th St., Racine, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Landis Tool Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
Bay State Abrasive Products Co, Westboro, Mass.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Machine Co., Grinding Wheels Div., Cincinnati, Ohio.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engrg. Co., Alliance, Ohio.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

(*Continued on page* 380)

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MACHINE SCREWS
SHEET METAL SCREWS
DRIVE SCREWS
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HARTFORD SPECIAL
AUTOMATIC THREAD ROLLERS
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AUTOMATIC DRILLING & TAPPING MACHINES
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SHORTER CLAMPING GIVES AVERAGE OF 70% MORE TIP REGRINDING!

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- Use Heavier Feeds — Higher Speeds on heavy-duty and extra-heavy-duty jobs.
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Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Electric
Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

HAMMERS, Power
Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft
Chambersburg, Engrg. Co., Chambersburg, Pa.

HAMMERS, Steam
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

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Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame
Cincinnati Milling Machine Co., Cincinnati, Ohio.

HARDENING, Surface
Electrolizing Corp., 1505 East End Ave., Chicago Heights, Ill.

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Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HOISTS, Chain, Etc.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

HONES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co. (Internal & External), 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, External
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

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HYDRAULIC MACHINERY, Tools and Equipment
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati Ohio.

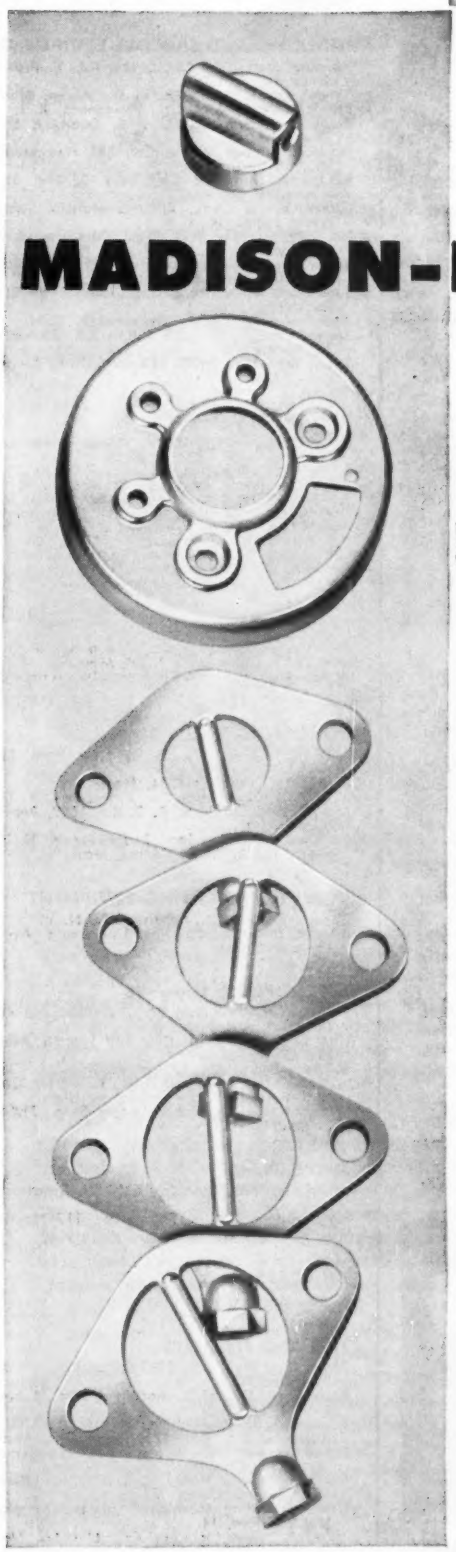
(Continued on page 382)

DESIGNING

for maximum tool usage
at minimum cost
with

MADISON-KIPP

ZINC AND ALUMINUM DIE CASTINGS



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Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg Co., Chambersburg, Pa.
Cross Co., 3250 Believue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

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Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston, 35, Mass.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.

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Bellows Co., 230 W. Market St., Akron, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co, 254 Laurel Ave., Des Plaines, Ill.
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Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starret, The L. S., Co., Athol, Mass.

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Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

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Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
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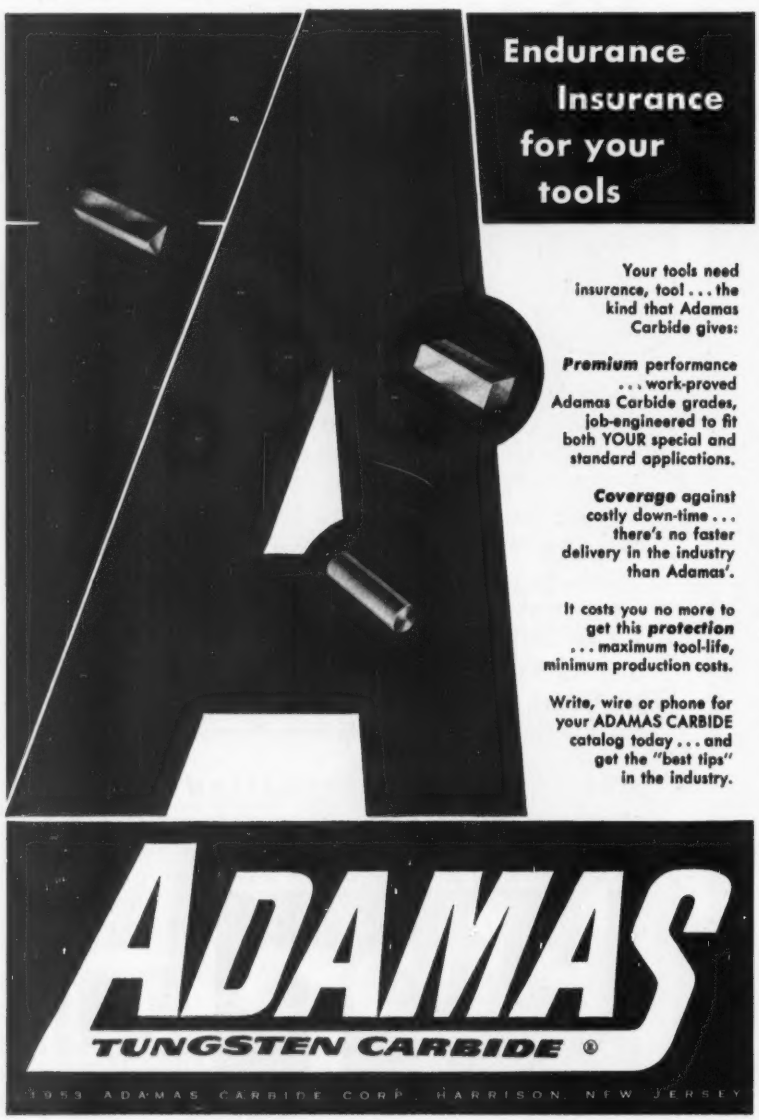
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.

(*Continued on page* 384)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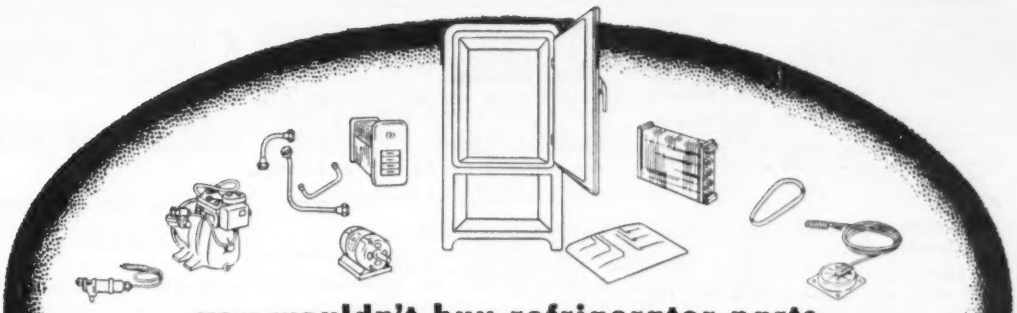

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Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
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Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
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Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
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Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Hendey Machine Co., Inc., Torrington, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
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Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
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Pratt & Whitney, West Hartford 1, Conn.
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Schutte, Alfred, H., Koln-DEUTZ, Germany
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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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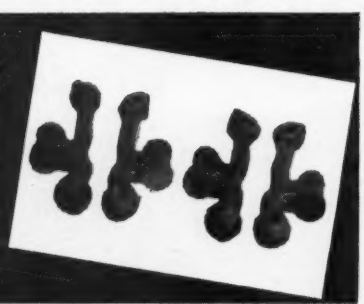
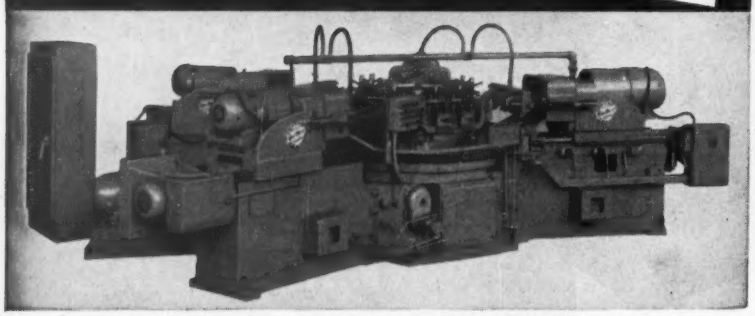
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.

(Continued on page 386)

Drilling and Reaming

388 KING PIN HOLES PER HOUR





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On a Davis & Thompson 5 Station Machine

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1. Drill 53/64" dia.—Half way through.
2. Drill .823" dia. — Balance of way through.
3. End Cut Ream .8547/.8550" — Full length of hole.
4. Finish Ream .8635/.8637"—Full length of hole.
5. Load and Unload.

Two RH and two LH pieces are completed at the end of each cycle. Cycling is automatic, and, operator loads and unloads during machine cycle.

4 New Davis & Thompson Mechanical Power Heads

Included in the design of this machine are the new ROTO-MATIC Mechanical Electrical Power Heads operated through screw feed. An important safety feature of these units is the patented overload release clutches on the feed. Because of the simplicity of their design the units require a minimum of servicing.

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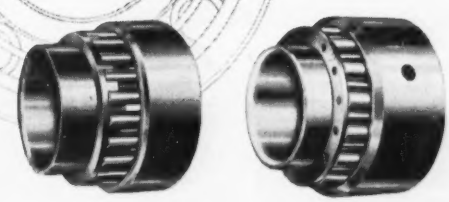

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South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

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H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
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Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
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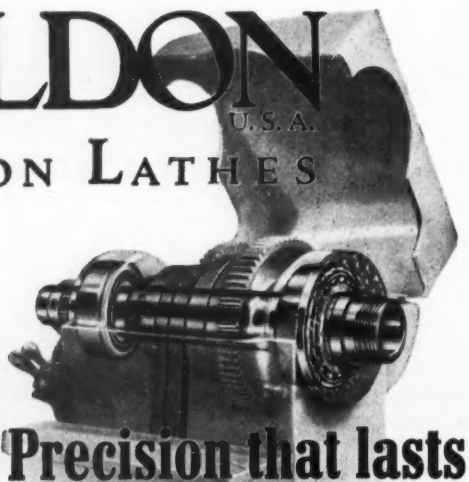

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hendey Machine Co., Inc., Torrington, Conn.
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Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
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Springfield Mch. Tool Co., Springfield, Ohio.

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H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Corp., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
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(*Continued on page* 388)

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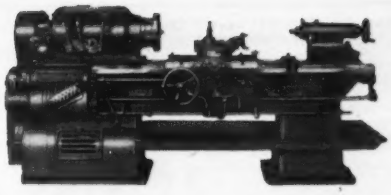
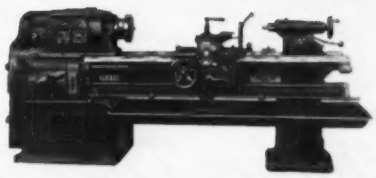
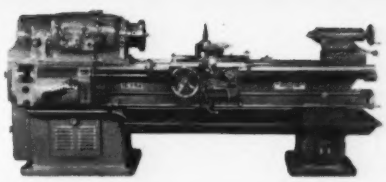


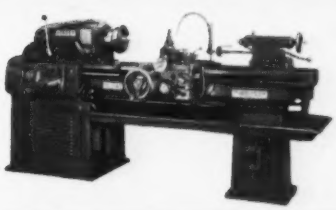
18″ — 20″ — 24″ 12-speed Geared Head Lathes



12″ — 14″ — 16″ 18-speed Geared Head Lathes



12″ — 14″ — 16″ 12-speed Geared Head Lathes



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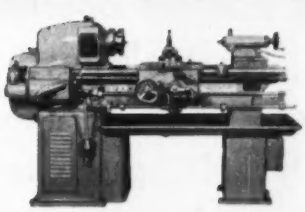
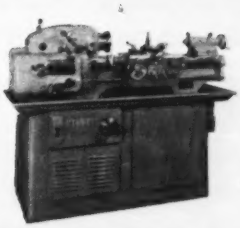


No. 1 General Purpose Lathe



9″ x 24″ Tool & Gage-Makers' Lathe

Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Jones & Lamson Mch Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lehmann, J. M., Co., Inc. 55 New York Ave., Lynhurst, N. J.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LOCKNUTS

Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

LUBRICANTS, Including Extreme Pressure (EP) Machinery Lubricants

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.

MASKS, PAINTING

Conforming Matrix Corp., 342 Toledo Factories Bldg., Toledo 2, Ohio.

MEASURING MACHINES AND INSTRUMENTS, Precision

Alina Corp., 401 Broadway, New York 13, N. Y.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METERS

See Recording Instruments.

MICROMETERS

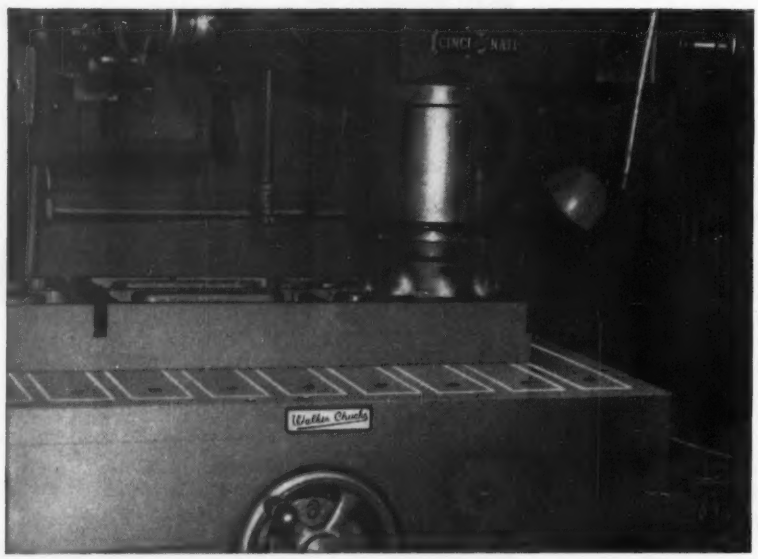
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MICROSCOPES, Toolmakers

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

(*Continued on page* 390)

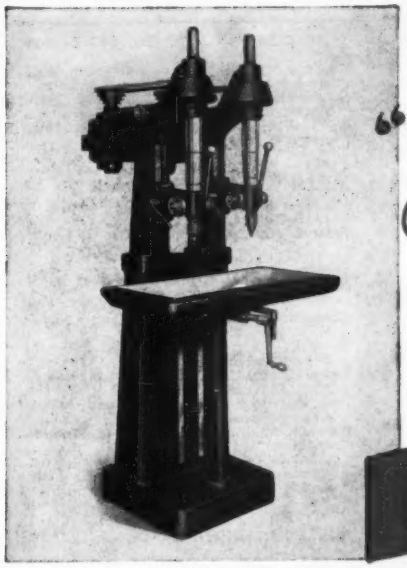
Walker Does It Again—



Milling machine operating a carbide cutter 660 f.p.m.; table feed 25 i.p.m. on rough steel castings. Walker Magnetic Chuck, securely holding workpiece, increases production equivalent to work of four planers. Take advantage of modern Walker methods for increasing production, reducing cost.

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

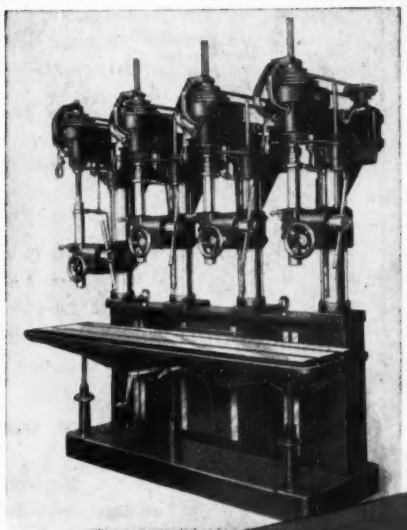
In Canada—Upton Bradeen & James, Ltd.



"Buffalo" BUILDS the DRILL that can cut your

- REJECTS
- WASTE MOTION
- FATIGUE

. . . IN THE TOOL ROOM . . . OR "ON THE LINE"



You can pick a "Buffalo" Drill matched to the exact drilling, tapping or reaming jobs you do, and get a real saving in time and costs. At upper left is one example—the "Buffalo" No. 14 High Speed Sensitive Drill for accurate work on precision parts using drills up to ½".

Seven other models, up to 2" capacity in cast iron, are available. All controls are placed for almost effortless operation. Speed changes and table or head raising or lowering are all done rapidly.

For JOB DRILLING or "MARATHON" RUNS

Whether you need a machine for odd-job drilling, tool room work or long production runs, "Buffalo" builds it. At right is the famous "RPMster," the drill with 1001 speeds instantly changed. At left is the big, rugged "22" that's as easy to handle as small sensitive drills. As a first step towards getting *your* drilling costs down, why not write us for recommendations on your problem? Thousands of plants have benefited by doing this.

"Buffalo" MACHINE TOOLS

BUFFALO FORGE COMPANY

440 BROADWAY — BUFFALO, NEW YORK

Canadian Blower & Forge Co, Ltd., Kitchener, Ont.

DRILLING — PUNCHING — CUTTING — SHEARING — BENDING

MILLING ATTACHMENTS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

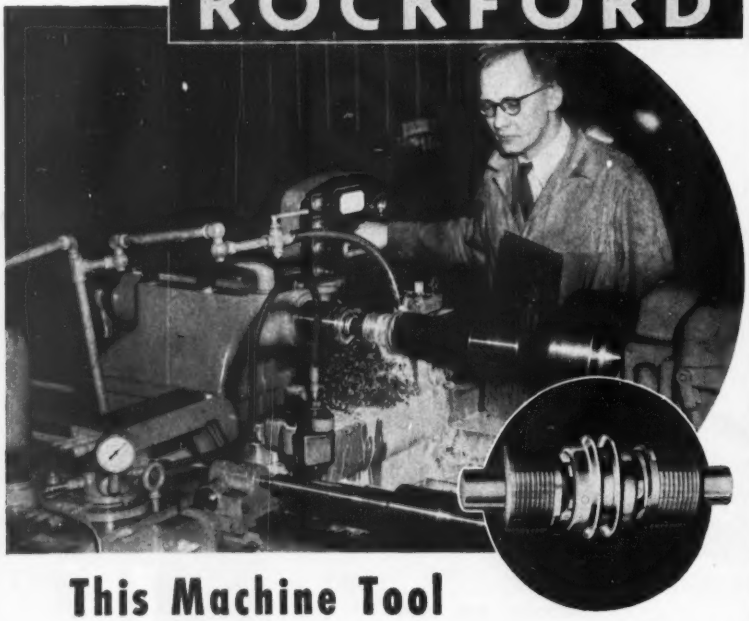
MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.

CLUTCHES by ROCKFORD



This Machine Tool "Feels" It's Way

The Monarch "Air-Gage Tracer" machines different diameters, tapers, bevels, forms, grooves, undercuts, shoulders, necks and chamfers in a single, continuous operation — duplicating the template form within exceedingly close limits. A ROCKFORD Pullmore CLUTCH serves as a brake in the headstock. Let ROCKFORD clutch engineers help your designers develop highly accurate power transmission control for your machines.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
410 Catherine Street, Rockford, Illinois, U.S.A.

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Marac Mchry. Corp., 1819 Broadway, New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

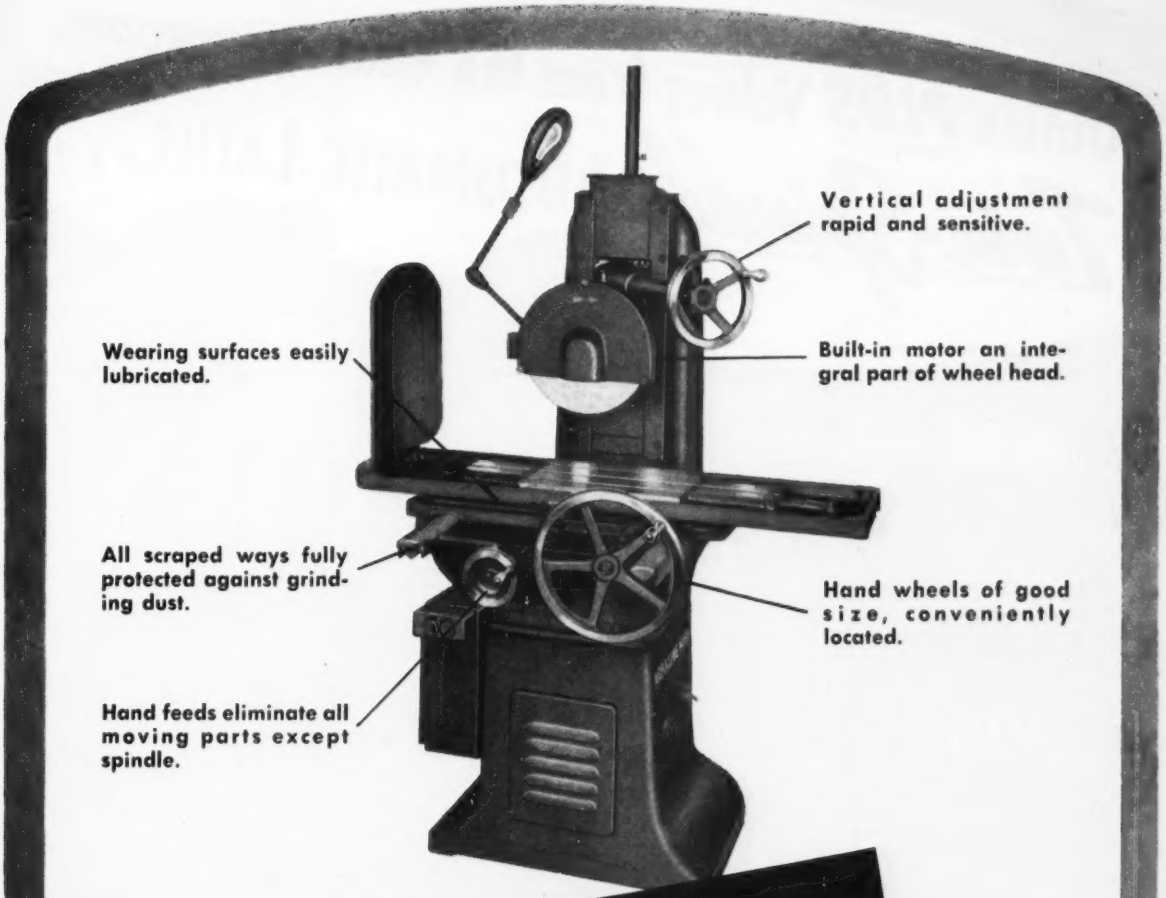
MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

(Continued on page **393**)


Vertical adjustment rapid and sensitive.
Built-in motor an integral part of wheel head.
Hand wheels of good size, conveniently located.
Wearing surfaces easily lubricated.
All scraped ways fully protected against grinding dust.
Hand feeds eliminate all moving parts except spindle.

ABRASIVE No. 1½ Toolroom Surface Grinder

Little Grinder with Big Ideas

Give your toolmakers the grinder that's big enough for most toolroom jobs. Abrasive No. 1½ takes work up to 15" long x 10" wide x 12" high — 150 sq. in. of table working surface! Nearly 50% more than most small surface grinders. Work produced on this grinder satisfies every requirement for accuracy, fine finish, and flatness. This is a precision tool of extremely simple design — a popular tool wherever one-of-a-kind jobs have to be ground fast, efficiently, and with a minimum of fuss and bother. Send for catalog describing Abrasive No. 1½ Surface Grinder. Abrasive Machine Tool Company, Dunellen Road, East Providence 14, Rhode Island.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

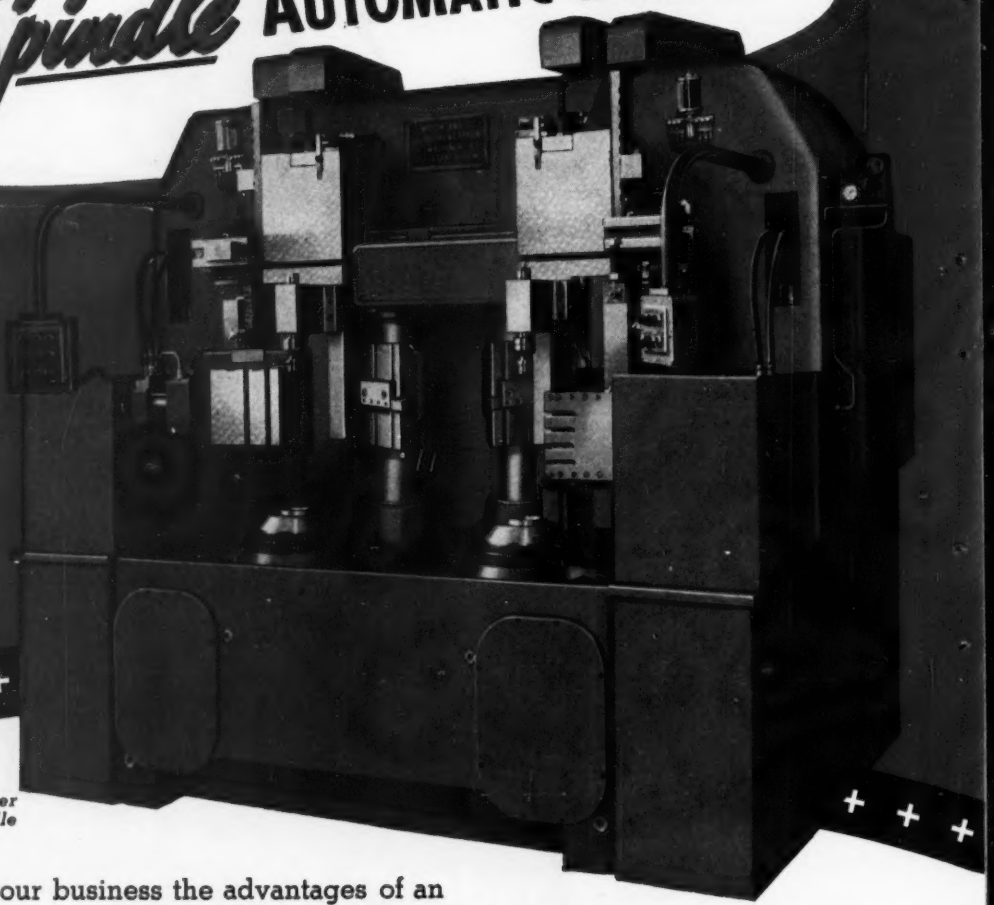
Abrasive Quality is Reflected in the Finish of Your Product

Obtain *PLUS* Values from the Motch & Merryweather *Twin-Spindle* Automatic Lathe...

GET PLUS PRODUCTION!

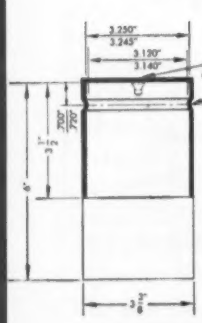
GET PLUS ACCURACY!

GET PLUS PROFITS!



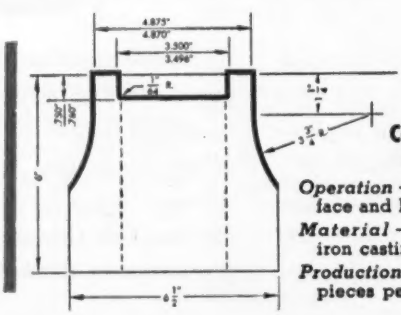
Motch & Merryweather VTBF-12 Twin Spindle Automatic Lathe.

Command for your business the advantages of an automatic turning-boring-facing cycle with precision — *plus* the value of *twin yet independent* spindles — *plus* the value of vertical facility for handling parts. These machines are accurate, rugged, and dependable, yet simple to set up.



Case Study No. 96

Operation — Turn, face, groove and center drill.
Material — SAE 1335 annealed.
Production — 124 pieces per hour.



Case Study No. 124

Operation — Turn, face and bore.
Material — Gray iron casting.
Production — 60 pieces per hour.

STANDARD SPECIFICATIONS

Chuck diameter	10"
Swing	12" dia.
Work height: chucking	12"
between centers	16"
Turning slide, vertical feed	14"
Boring slide, vertical feed	14"
Facing slide, horizontal swing	6"

★ ★ ★

Individual, selective hydraulic feed for each slide. . . . Special variations to meet individual requirements. . . . Simple contours by cam-operated tools. . . . Tracer control can be added.

Manufactured by — THE MOTCH & MERRYWEATHER MACHINERY CO. —
CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, Production Milling, Turning and Special Machines

PRODUCTION-WITH-ACCURACY MACHINES AND EQUIPMENT

Gray, G. A., Co., Woodburn Ave. and Penn. R. R. Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Planetary Type

Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Groton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

British Industries Corp., International Mchry. Div., 164 Duane St., New York, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Mchry. Co., 1819 Broadway, New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES

Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MOLDING MACHINES, Plastic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford. Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric

Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

MOTORS, Hydraulic

Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

Nilson Machine Co., A. H., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES

Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel

International Nickel Co., Inc., 67 Wall St., New York, N. Y.

NIPPLE THREADING MACHINERY

Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp. (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co. Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-Locking

Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

(*Continued on page 394*)

Now . . more than ever . .

Performance Counts!

Procunier Universal TAPPING MACHINES with the *NEW* "Hi-Boy" Lubricating Pump

"Better performance under all conditions" . . . is what shop men say about the Procunier Tapping Machine with the "Hi-Boy" Lubricating Pump. Tested on many kinds of tapping operations . . . these new "job tested" pumps are enabling operators to cut cleaner, faster, deeper threads with greater ease. They also permit tapping in tougher, harder metals with less tap breakage. The "Hi-Boy" is a motor-driven gear type pump which provides a continuous flow of lubricant to the tap at all times . . . even while "backing" out.

The famous Procunier foot pedal mechanism leaves the operator's hands free for work. The unique compensating springs may be pre-set for proper pressure to tap . . . regardless of pedal pressure.

The result is high speed, uniform tapping with a minimum of broken taps . . . *better performance of every job.*

Write for FREE Circular

giving full details on this universal tapping machine and how it can help you in your shop.

Procunier
Safety Chuck Company
16 S. CLINTON ST., CHICAGO 6, ILL.

PROCUNIER SAFETY CHUCK CO.
16 S. Clinton St., Chicago 6, Ill. Dept 6

Gentlemen: Please send me your illustrated brochures which give complete prices and specifications on Procunier High Speed Tapping Heads and Machines.

Name .....
Address .....
City ..... Zone..... State.....

NUTS, Thumb or Wing and Cap
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.

OIL CUPS
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL EXTRACTORS AND CLEANERS
De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS
Wicaco Machine Co., Stenton Ave. and Louden St., Philadelphia, Pa.

OIL-HOLE COVERS
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL SEALS
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Bellows Co., 230 W. Market St., Akron, Ohio.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

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Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
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OPTICAL FLATS
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ORDNANCE MACHINES, Special
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PHOSPHOR BRONZE
See Bronze

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, BRASS AND COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE STEEL
Alleghany Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

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Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

(Continued on page 396)

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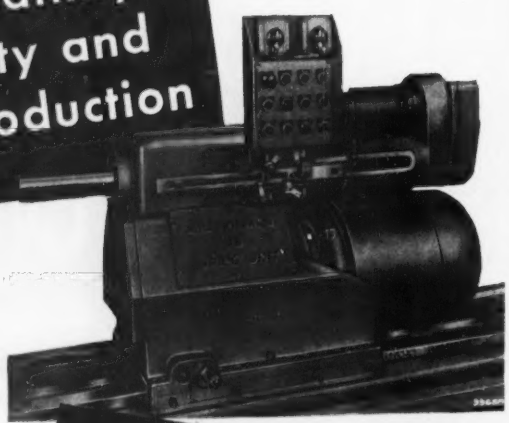

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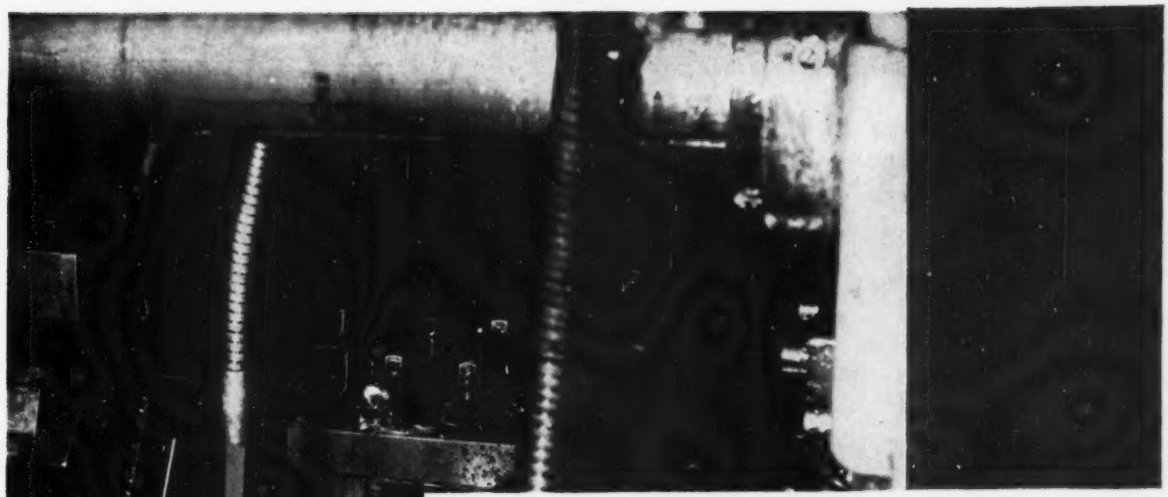

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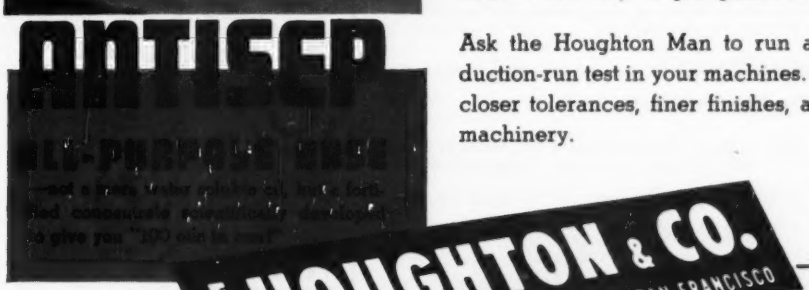

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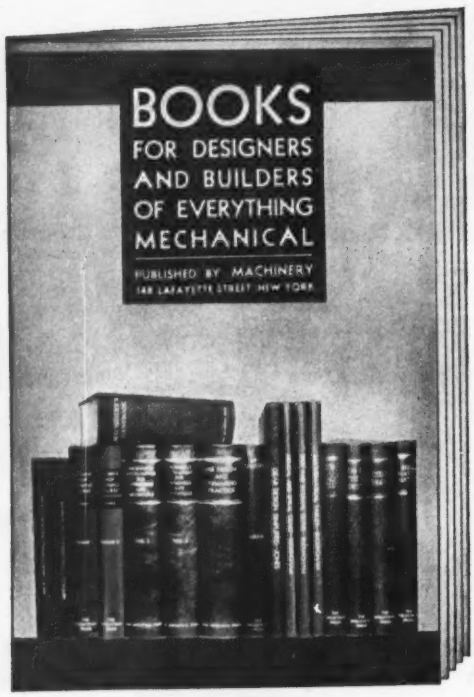

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Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
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Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

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Bellows Co., 230 W. Market St., Akron, Ohio.
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Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

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Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

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Jarvis, Charles L., Co., Middletown, Conn.
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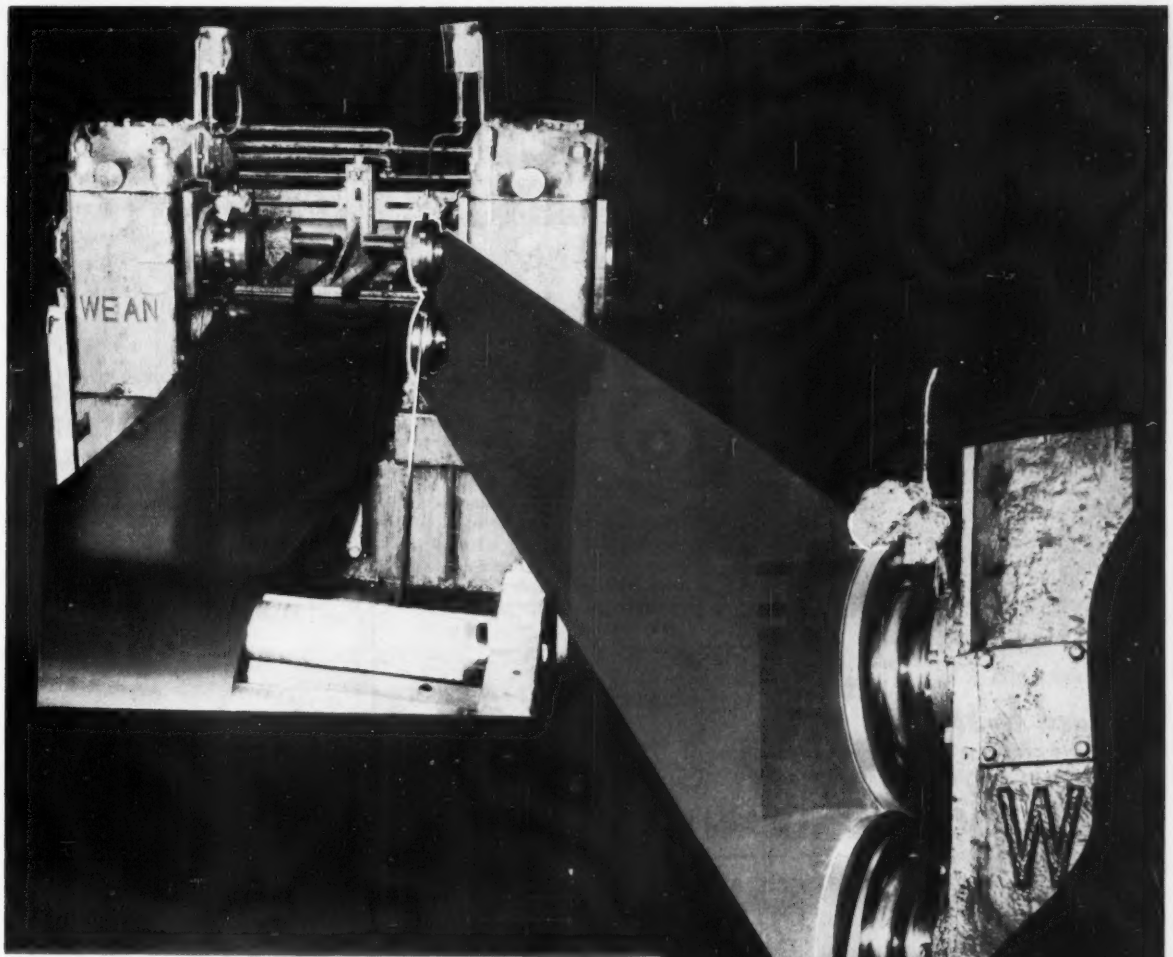
POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads.

(*Continued on page* 398)



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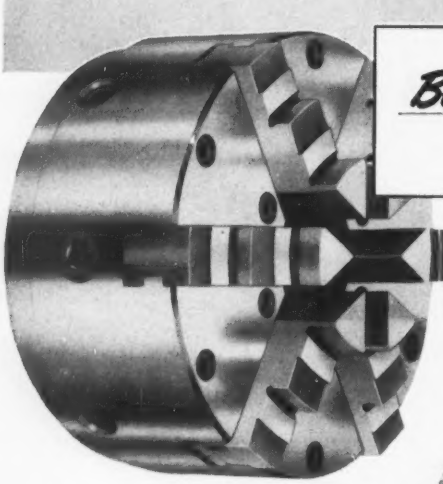

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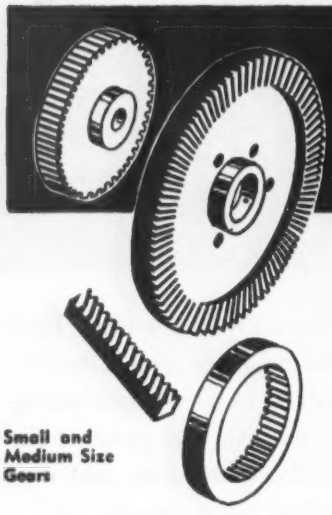

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Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
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Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
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Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
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(*Continued on page* 400)

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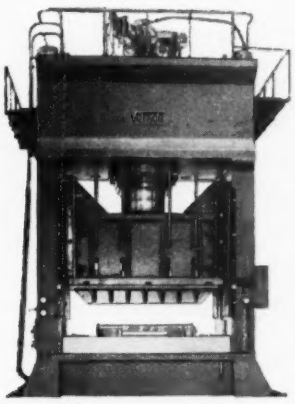

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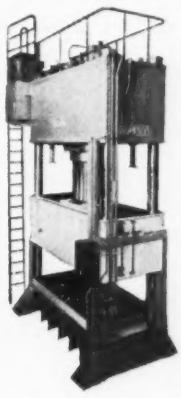

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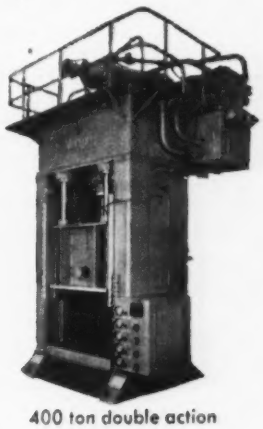

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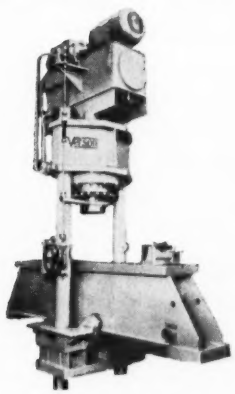

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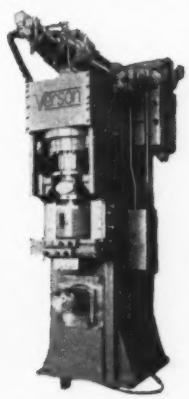

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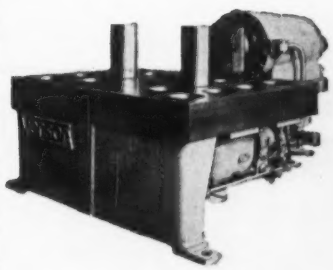

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Bethlehem Steel Co., Bethlehem, Pa.
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Chambersburg Engrg. Co., Chambersburg, Pa.
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Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
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Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
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Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

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Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

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Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.

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Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Sales Service Mch. Tool Co., 2363 University Ave., St. Paul, Minn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc, 1700 E. Grand Ave., El Segundo, Calif.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Mchry. Co., Inc. (and affiliated companies), 410 Broome St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pines Engineering Co., Inc., Aurora, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.

(*Continued on page* 402)

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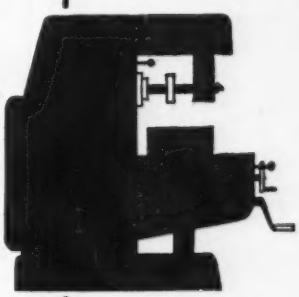

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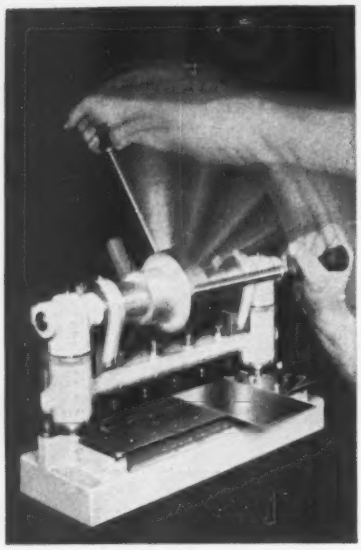

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South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Gerotor May Corp., Oliver St. and Maryland Ave. Baltimore, Md.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Ill.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

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Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS

Atrax Co., Newington, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
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Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
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(*Continued on page* 404)

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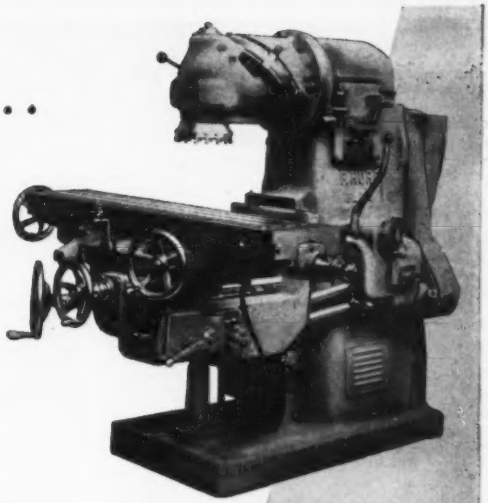

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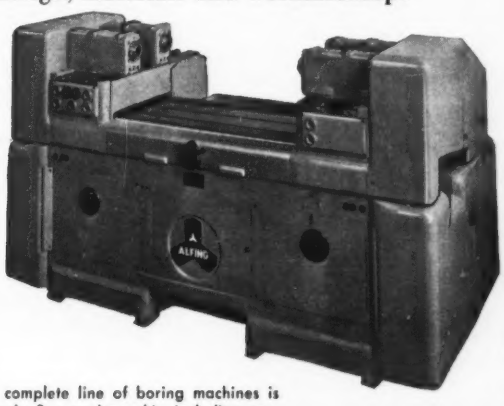

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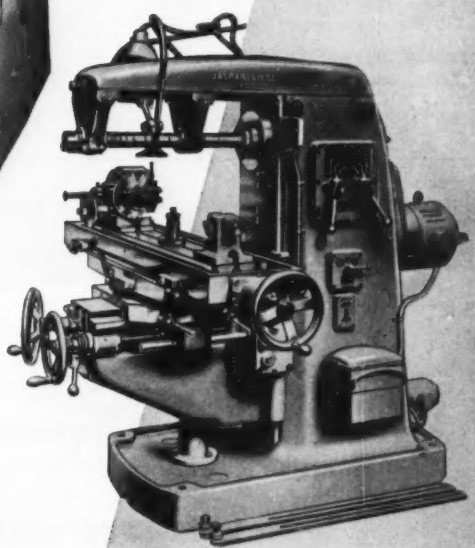

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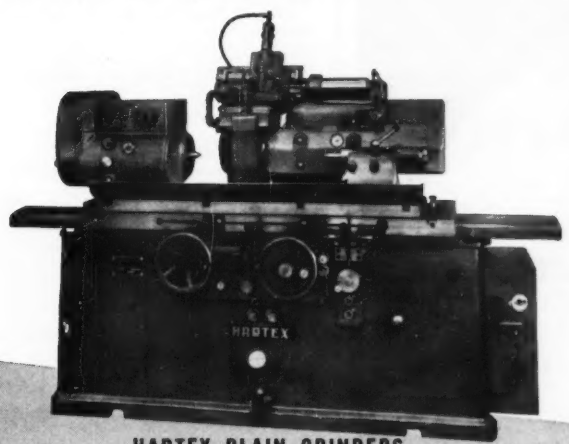

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Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

REAMING MACHINES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Greaves Machine Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
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Pratt & Whitney, West Hartford 1, Conn.
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Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Peck, Stow & Wilcox Co., Southington, Conn.
Thor Power Tool Co., Aurora, Ill.

RIVETERS, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.

RIVETING MACHINES
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Tomkins-Johnson Co., Jackson, Mich.

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National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

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RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

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Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
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SANDERS
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Chicago Pneumatic Tool Co., 6 E 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.

SAW BLADES, Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.

SAW SHARPENING MACHINES
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Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsourgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
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Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.

(*Continued on page* 406)

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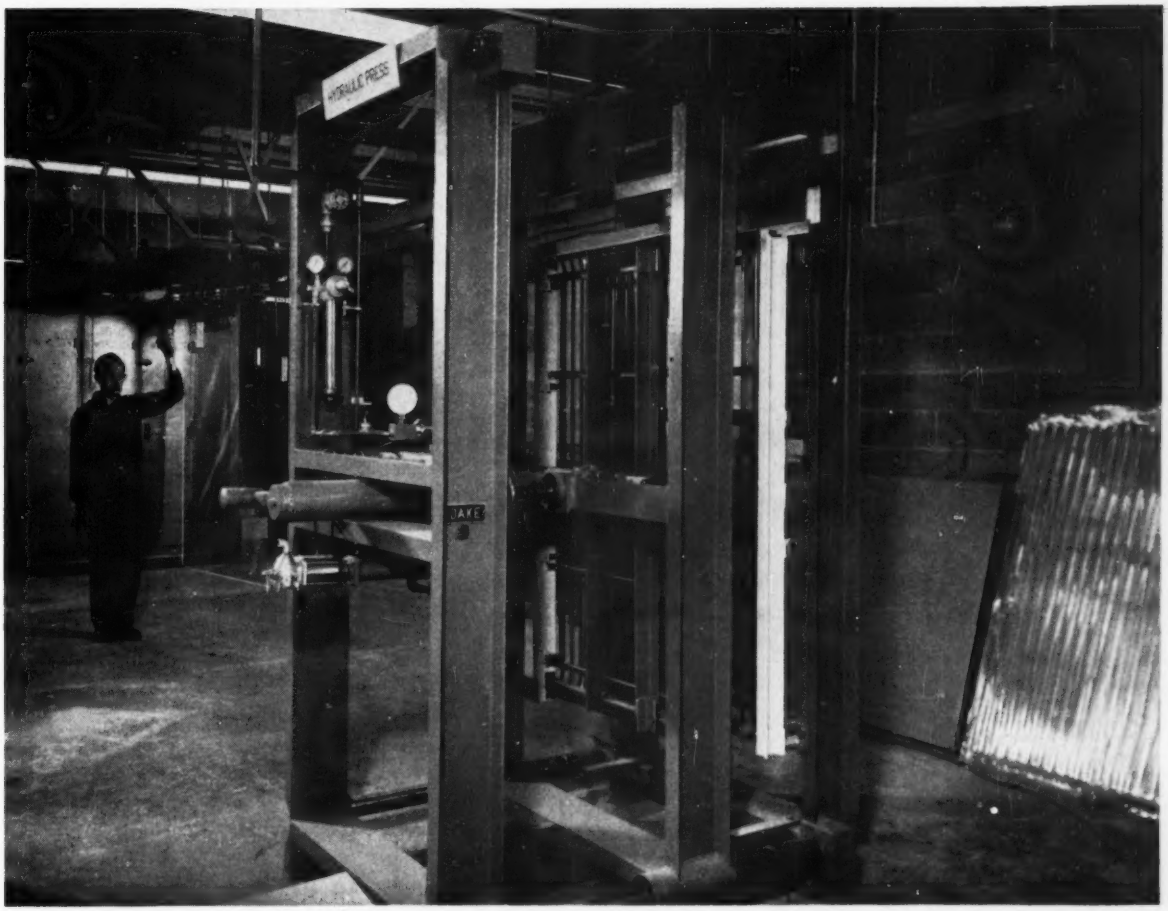

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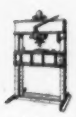
DAKE PRESSES

Arbor Presses


Hand-Operated Hydraulic

Power-Operated Hydraulic

Guided Platen

Gap Type Presses

Movable Frame

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plains, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

Alina Corp., 401 Broadway, New York 13, N. Y. (Portable.)
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Ohio.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Eastern Mch. Screw Corp., New Haven, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

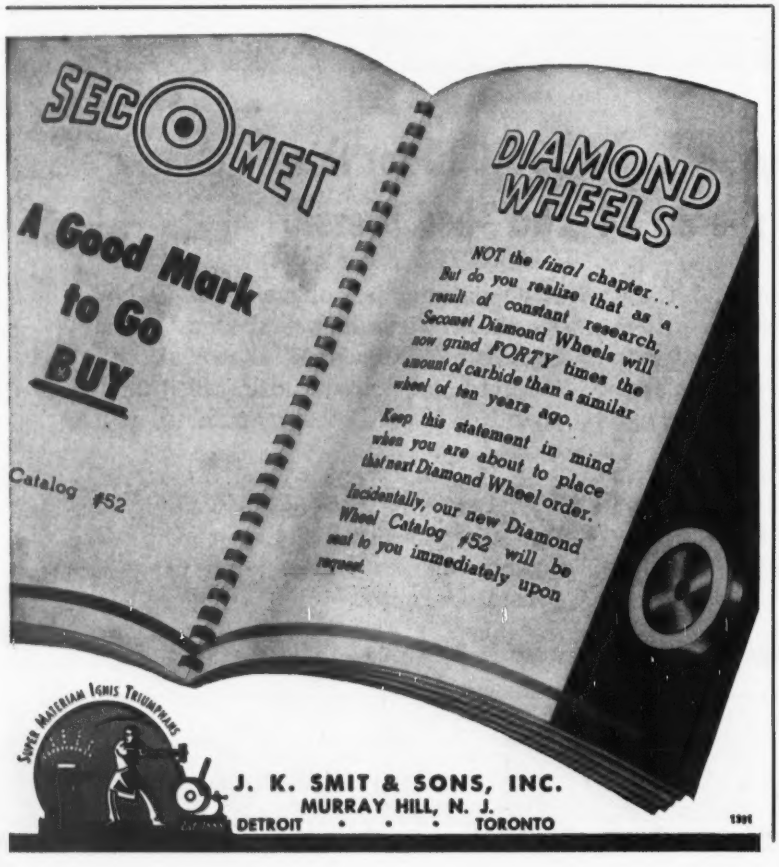
See also Lathes, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

(*Continued on page* 408)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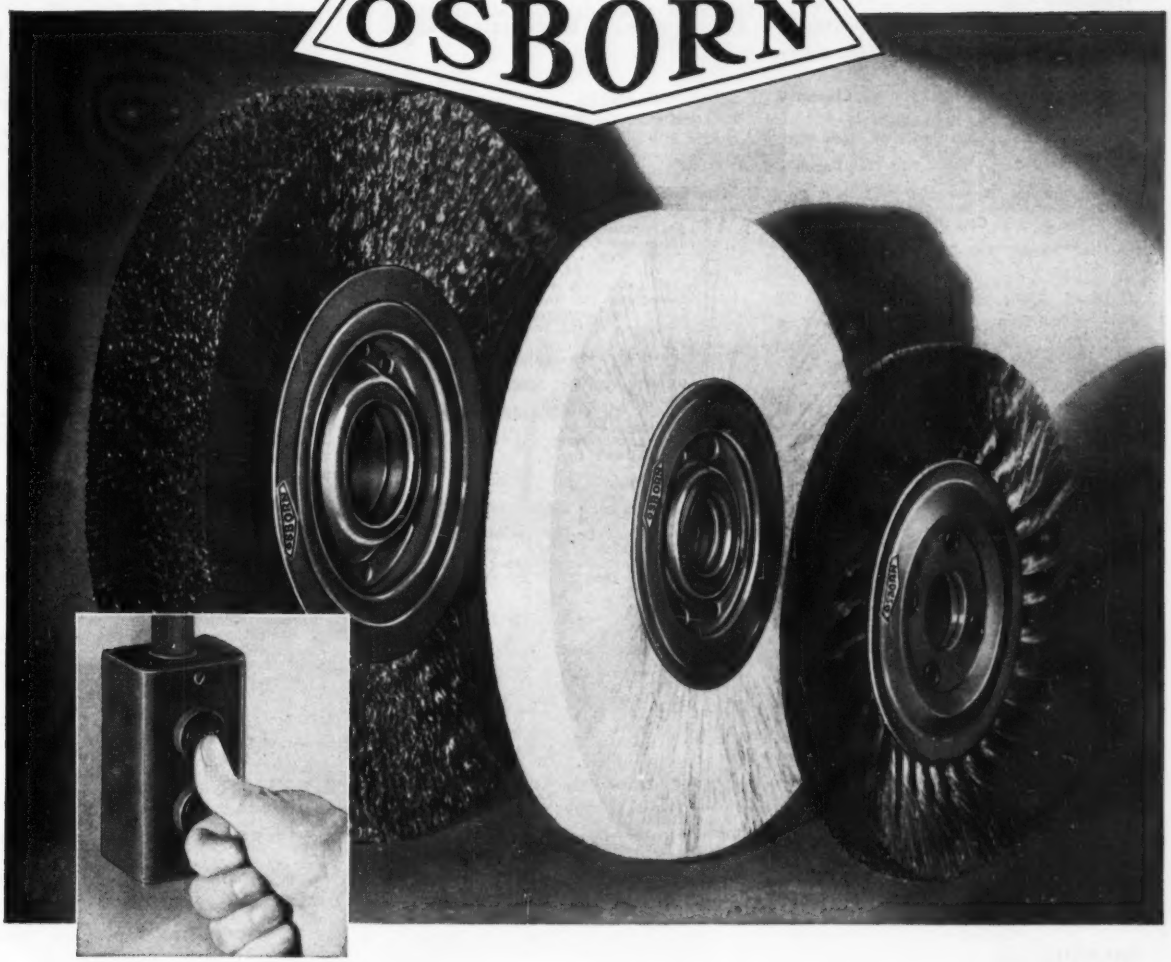

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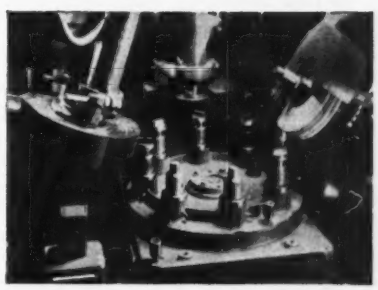

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Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Set Screw & Mfg. Co., 35 Main St., Bartlett, Ill.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive

Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

SCREWS, Thumb

Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

SEALS AND RETAINERS, Oil or Grease

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

SECOND-HAND MACHINERY, Etc.

Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal

De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant

Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland Ohio.

SHAFTING, Steel

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son., Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS

National Forge & Ordance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS, Flexible

Jarvis, Chas. L., Co., Middletown, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.

SHAFTS, Hollow-Bored

Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground

Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
National Forge & Ordance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPER-PLANERS

Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hendey Machine Co., Inc., Torrington, Conn.
Morton Mfg. Co., Muskegon Heights, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical

British Industries Corp., International Mchry. Div., 164 Duane St., New York, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Cold Drawn Steel

Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPES, Structural

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg., Lake City, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheriden Rd., Kenosha, Wis.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Corp., Bethlehem, Pa.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son., Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEETS, Iron and Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Corp., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc.. 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS

Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES

Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist & Drill Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati,
Baldwin-Lima-Hamilton Corp., Philadelphia 42,
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
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(*Continued on page* 410)

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H.E.B. Pilote

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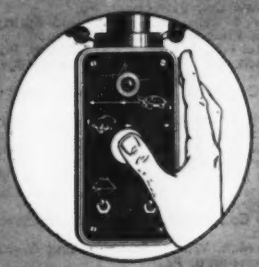
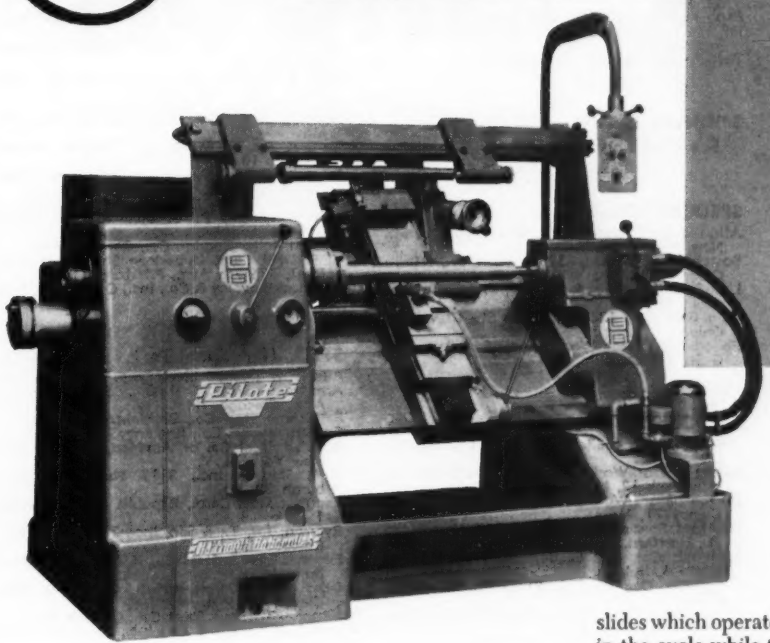


HYDRAULIC COPYING LATHE



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Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg Co., Chambersburg, Pa.
Colonial Broach Co., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Douglas Tool Co., 2300 E. Nine Mile Rd., Hazel Park, Mich.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
OK Tool Co., Milford, N. H.
Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg Co., Frankenmuth 2, Mich.
V & O Press Co., Div. Emhart Mfg Co., Hudson, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
James, D. O. Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverill, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, All Metal

LaSalle Steel Co., Hammond, Ind.
Mullins Manufacturing Corp., Salem, Ohio.

STAMPINGS, Sheet Metal

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Laminated Shim Co., Inc., Glenbrook, Conn.
Mullins Manufacturing Corp., Salem, Ohio.
Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STAMPS, Steel and Marking Dies

Hoggson & Pettis Mfg. Co., 149 Brewery St., New Haven, Conn.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co., 208 S. LaSalle St., Chicago 4, Ill.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeiler Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

(*Continued on page* 412)

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absorption
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cushioning
filtration
insulation
lamination
polishing
pressing
refining
roll covering
and many other
specialized uses

FOR ALL INDUSTRY

EXPERIENCE

Our modern, efficient facilities, and 122 years of imaginative progress, have made Noone a leading manufacturer of woven fabrics designed for every conceivable industrial operation.

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Write us your problem: it will command the attention of our experimental division until its solution is found. Your difficulty may well be solved with the use of a woven fabric engineered to your needs and specifications.

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Zagar gearless drillhead, 12", 24-spindle; capacity up to 5/8" steel.

Zagar GEARLESS DRILLHEADS *excel* for drilling on close centers

Their unique features have earned for Zagar gearless drillheads a permanent place in many industries. Examples: gas burners, acoustical tile, parts for aircraft (jet engines), business machines, electrical appliances, automotive and farm machinery; drilling cast iron, stainless steel, paper, fiber glass, magnesium, aluminum, brass and copper.

Why this versatility? Because Zagar gearless drillheads (1) can drill practically any number of holes at one pass, up to 600 or more; (2) can drill any material; (3) can drill in any pattern; (4) can "come down to" distances between holes as small as twice the drill diameter; (5) can and do maintain accurate spacing. High production thus combines with complete accuracy to deliver more work and more acceptable work in less time than ever before. Zagar gearless drillheads can be furnished as complete units or can be adapted to any standard drill press. Your parts drawings and full data will bring you a prompt quotation.

Write for Engineering Manual "M-6" for more information on Zagar's tools for industry.

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ZAGAR TOOL, INC.
24000 LAKELAND BLVD.
CLEVELAND 23, OHIO

Zagar TOOLS For INDUSTRY and SPECIAL MACHINERY

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.

STEEL ALLOYS

See Alloys, Steel.

STEEL BARS

See Bars, Steel.

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

STONES, Oil or Sharpening

Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES

Starrett, The L. S., Co., Athol, Mass.
Tatt-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire

Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Rosselle, N. J.

STUD SETTERS

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

See Plates, Surface.

SWAGING MACHINES

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

SWITCHES

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Micro Switch Div., Minneapolis-Honneywell Regulator Co., Freeport, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

TACHOMETERS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

TAPER PINS, Standard

Chicago Screw Co., Bellwood, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Conn.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

TAPPING ATTACHMENTS AND DEVICES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.

(Continued on page 414)

For cost-cutting pressure control

MULTIPRESS®

1 TON
2 TONS
3 TONS
4 TONS
6 TONS
8 TONS
10 TONS
15 TONS
25 TONS
35 TONS
50 TONS
75 TONS

offers tonnages and controls for every need—including the new "touch control"

Multipress offers a *wide* choice of manual and automatic ram controls for every need . . . *accurately* adjustable ram speed, pressure, and stroke length . . . oil-smooth operation that reduces wear and tear on tooling—plus a full range of sizes and capacities from one ton to 75 tons.

And now Multipress is available *in all sizes* with Denison's new Touch Control.

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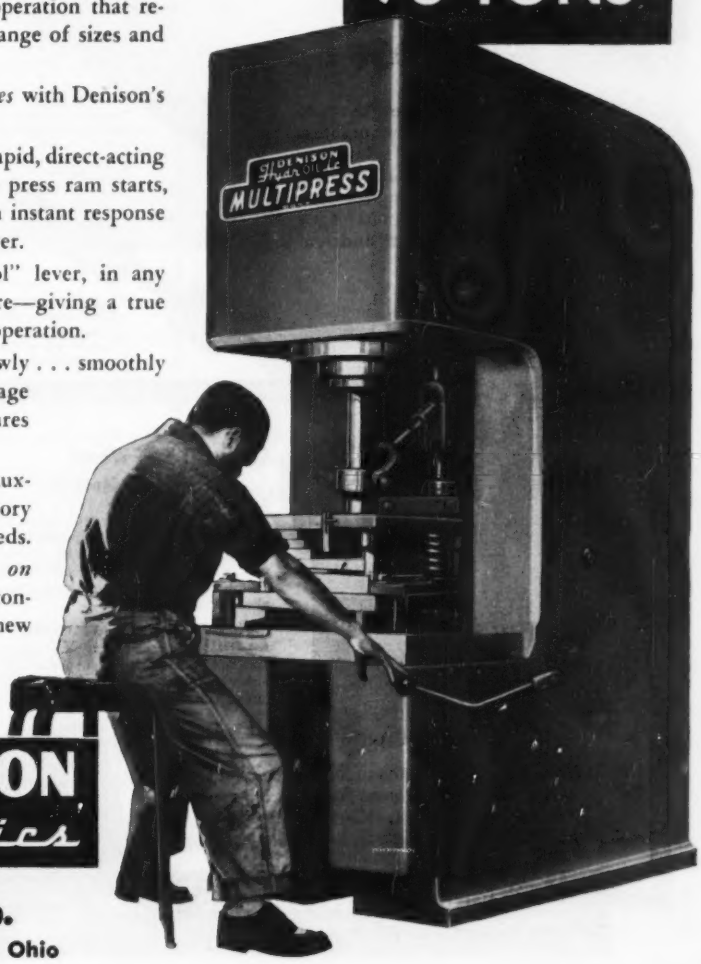
Pressure applied to the "Touch Control" lever, in any degree, is instantly multiplied in ram pressure—giving a true control "feel" of the pressure needs of any operation.

Ram effort can be built up rapidly or slowly . . . smoothly or in stages . . . and can be held at any tonnage for any needed dwell period. Applied pressures are shown on the dial gauge.

In addition, Multipress offers standard auxiliary feeds, tooling attachments and accessory equipment for many specialized production needs.

Write today for complete information on Multipress and the many types of Multipress controls, features and accessories — including the new Touch Control!



DENISON HydrOILics

The DENISON Engineering Co.
1152 Dublin Road, Columbus 16, Ohio

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jarvis, Chas. L., Co., Middletown, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS

Besly-Welles Corp., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., Detroit, Mich.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

TELESCOPES, Alignment

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., Detroit, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

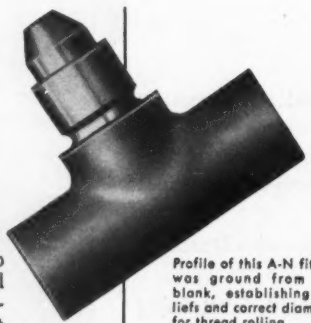
THREAD MILLING MACHINES

Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.

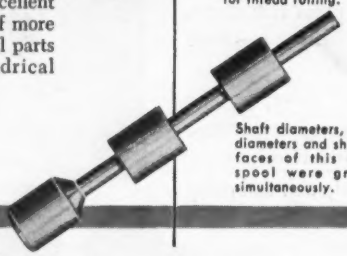
(*Continued on page* 416)

Who'd think of CENTERLESS GRINDING parts like these?

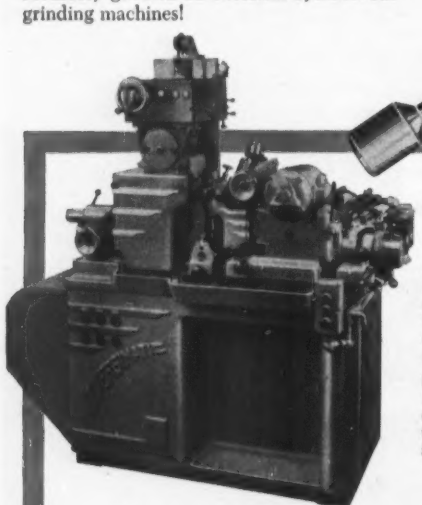
DIVERSIMATIC is opening new doors to the production minded! Parts long unsuited to centerless grinding are now being handled readily, with fast production, excellent finish and close tolerances. Savings of more than 500% have been made on small parts formerly ground on external cylindrical grinding machines!



Profile of this A-N fitting was ground from the blank, establishing reliefs and correct diameter for thread rolling.



Shaft diameters, major diameters and shoulder faces of this valve spool were ground simultaneously.



Choice of Two Wheel Profiling Methods

Diversimatic may be obtained with DIAMOND DRESSERS for profiling and dressing the wheel or with the exclusive CRUSH FORMING ATTACHMENT which establishes and maintains wheel profile almost instantaneously.

HANDY AS A TAPER ATTACHMENT ON A LATHE! The crush forming attachment does not interfere with conventional centerless grinding but *is ready to use* when form grinding is required!

If you have a production problem involving form work, finish and tolerance don't rule out centerless grinding—CALL IN DIVERSIMATIC—*the grinder with the spindle that needs no warm-up!*

DIVERSIFIED METAL PRODUCTS CO.
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NEW heat-treating
No guesswork in Brad Foote's modern, completely new heat-treating department. Note control panels with recording instruments.

Heat-Treating of gears is a science. It can bring out the ultimate of service life offered by quality alloys. Good heat-treating is dependent upon knowledge of heat-treating processes and skill in using fine heat-treating equipment.

• Illustrated above is part of BRAD FOOTE'S new $500,000 heat-treating department with modern equipment that removes the element of chance from a sometimes fallible job. Precise control equipment assures exact temperatures and timing—which means unvarying conformity to hardness specifications.

• The best in heat-treating at BRAD FOOTE is but another step in our complete control of the quality of every BRAD FOOTE gear, gearmotor, reducer, and transmission. It is your guarantee that you'll get satisfactory service if you use the gears yourself or build them into your equipment for use by others. No one shares our responsibility.

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Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
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Vanadium Alloys Steel Co., Latrobe, Pa.
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Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
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McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
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Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
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Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Rooseveit Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
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Kennametal, Inc., Latrobe, Pa.
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Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
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Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

(*Continued on page* 418)

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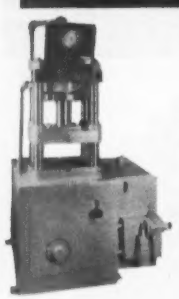

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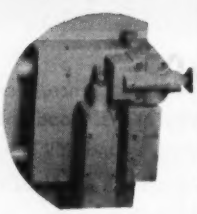

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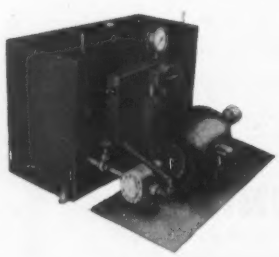

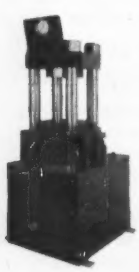

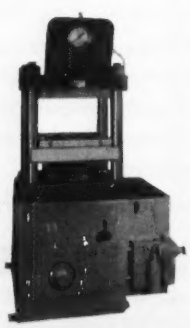

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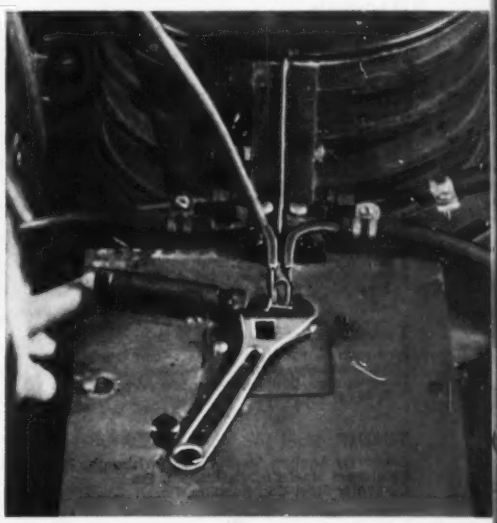

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Solar Steel Corp., Union Commerce Bldg., Cleveland, Ohio.
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Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
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Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
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Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
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Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bellows Co., 250 W. Market, Akron, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hendey Machine Co., Inc., Torrington, Conn.
Homestrand, Inc., Larchmont, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Martin, J. E., Mch. Works, 548 W. State St., Springfield, Ohio.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

(*Continued on page* 420)

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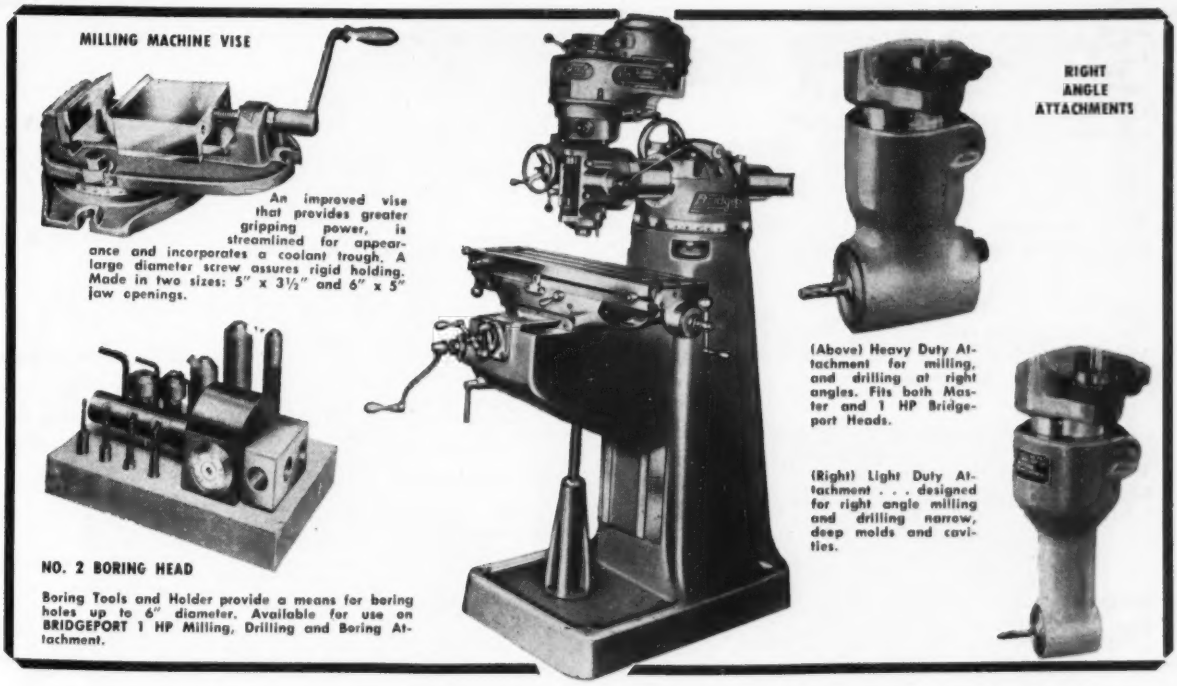
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Westinghouse Electric Corp., Pittsburgh 30, Pa.

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Delta Power Tool Div., Rockwell Mfg. Co., 641G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.

WELDMENTS

Mahon, R. C., Co., Detroit 34, Mich.
Woods, A. C., & Co., Div. Kropp Forge Co., 1129 Harrison Ave., Rockford, Ill.

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Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div), 436 7th Ave., Pittsburgh, Pa.

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Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
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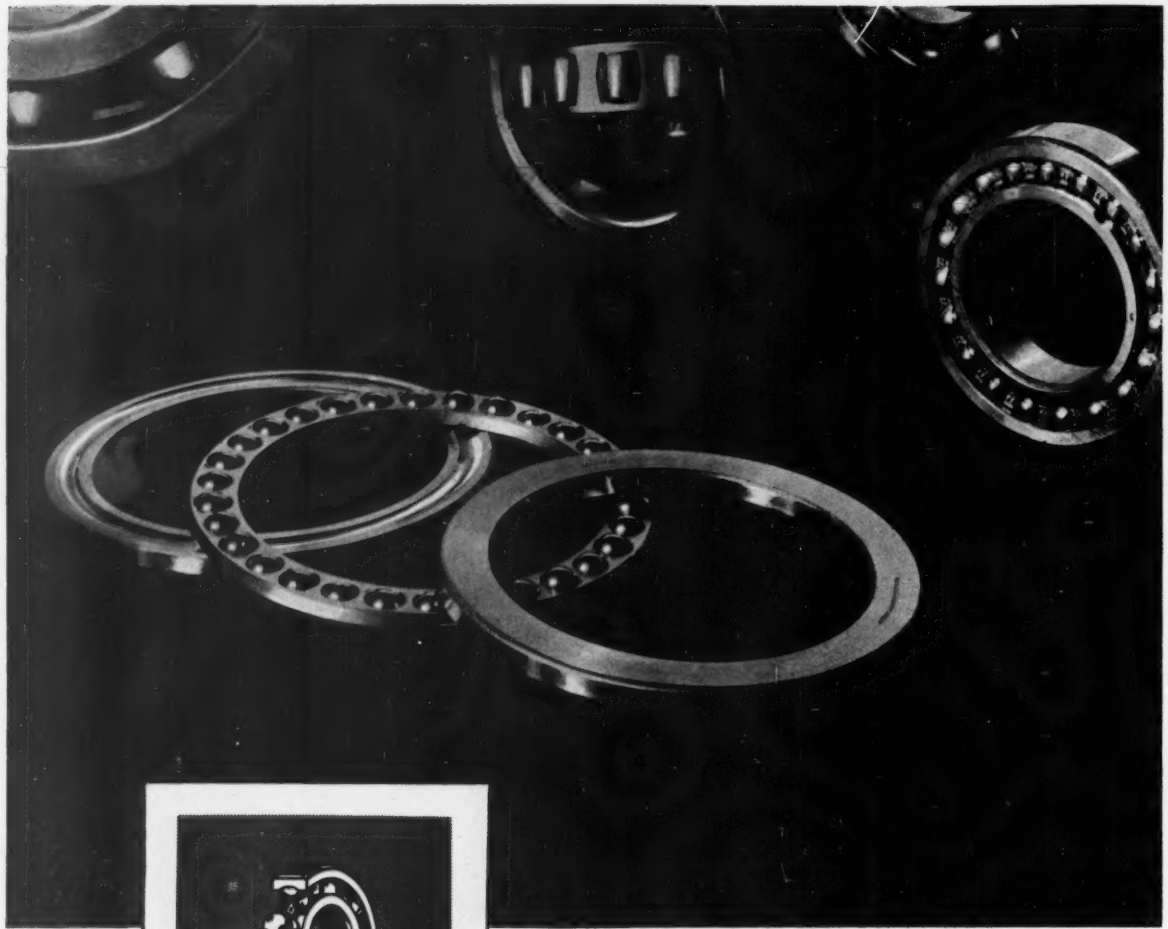

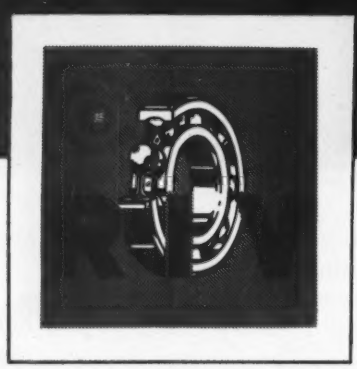

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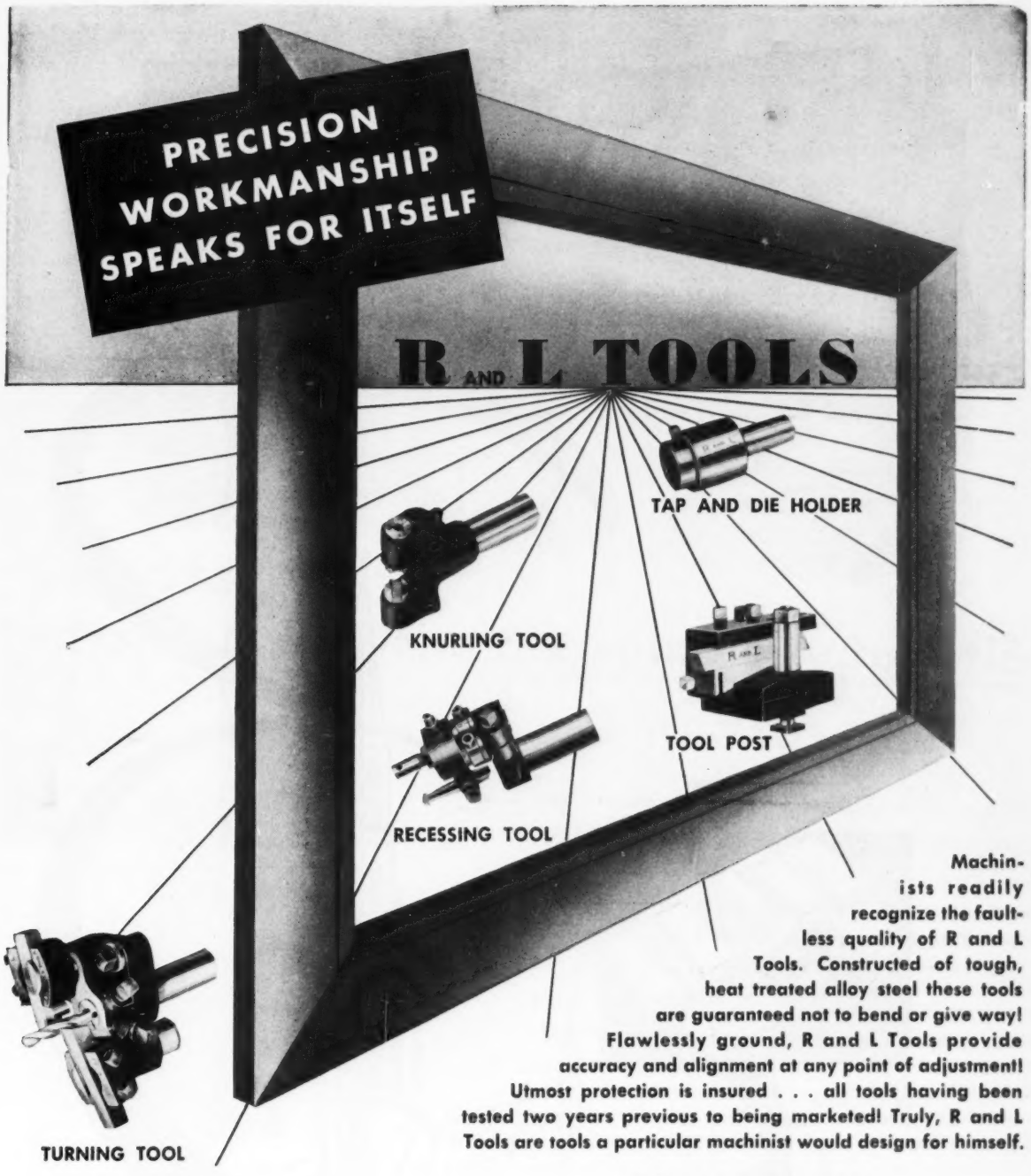

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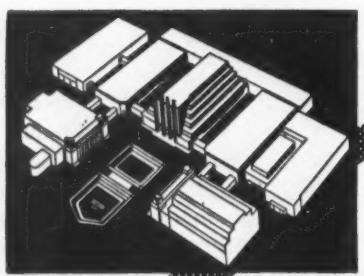

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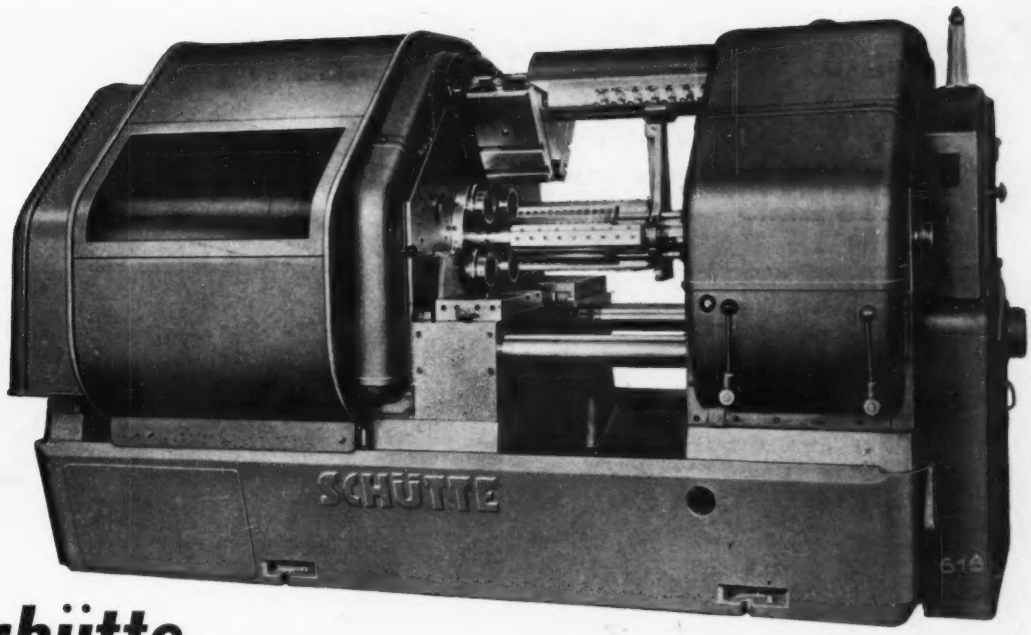

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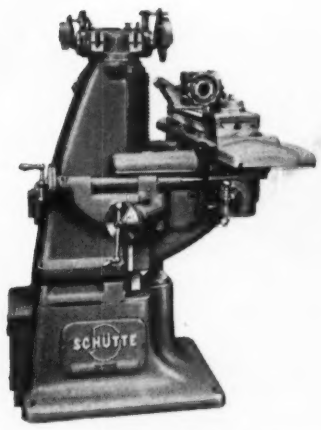

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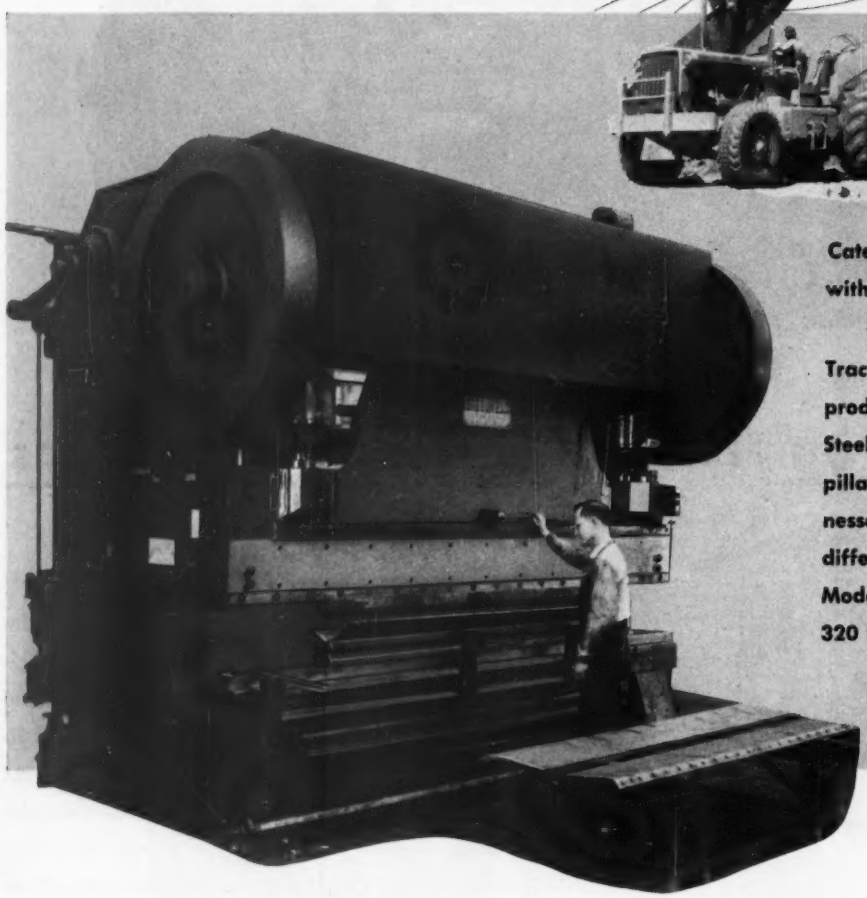

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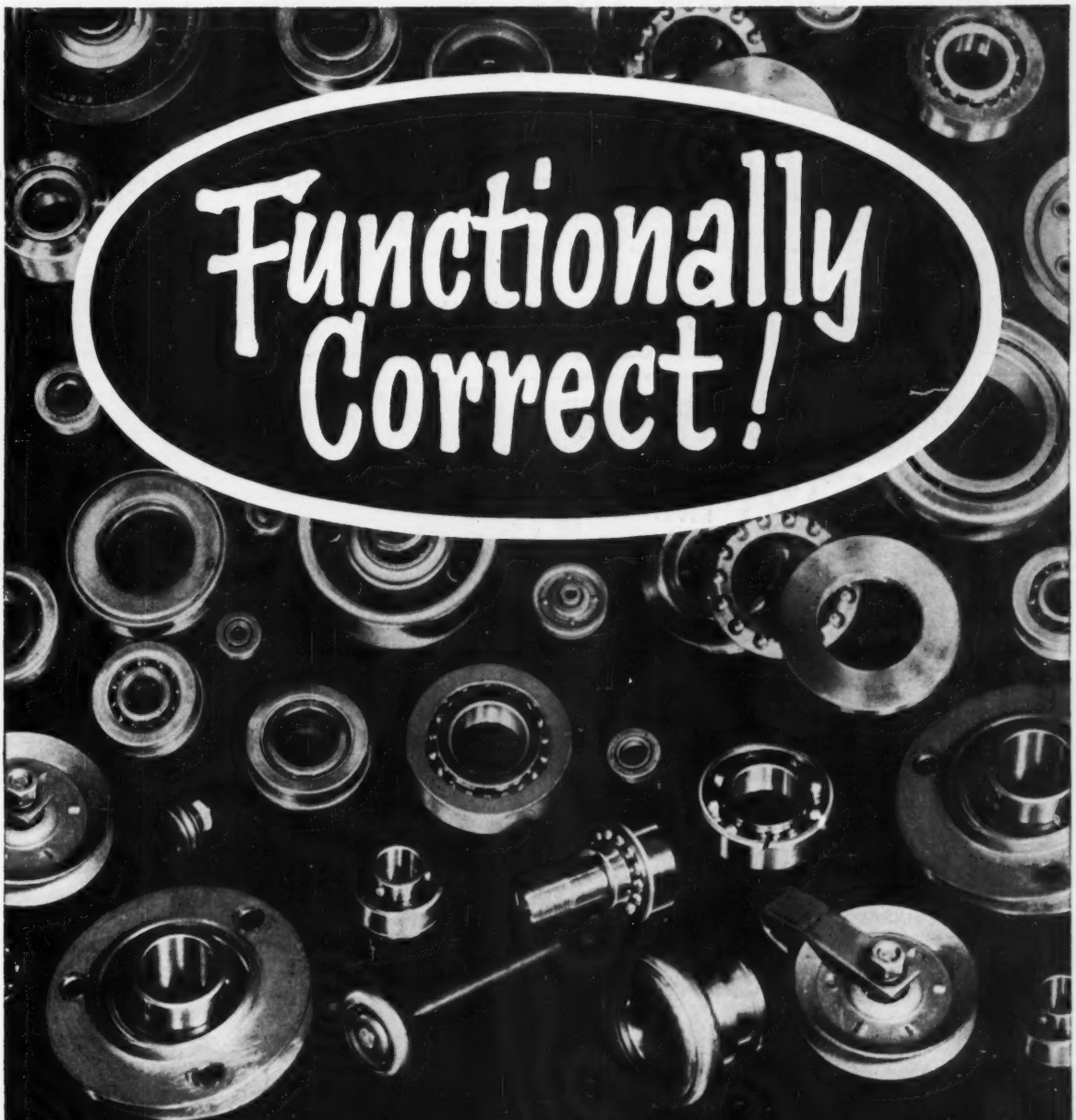

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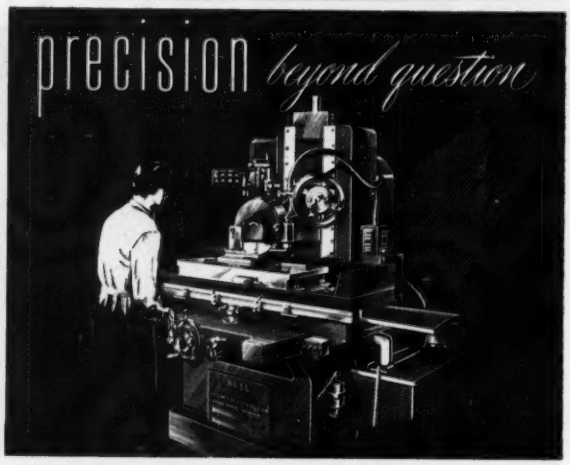

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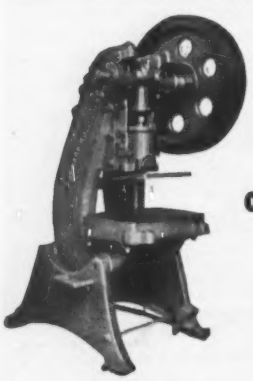

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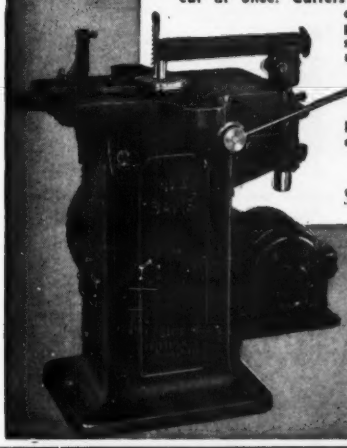

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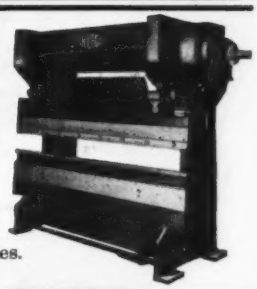

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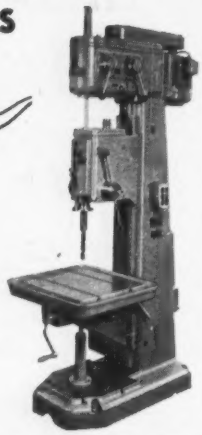

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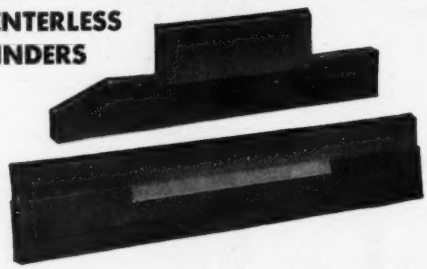

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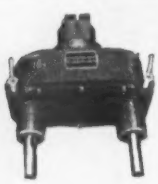

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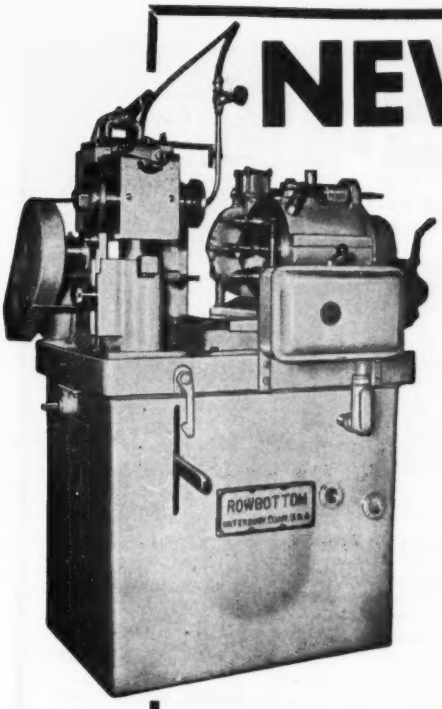

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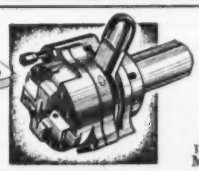

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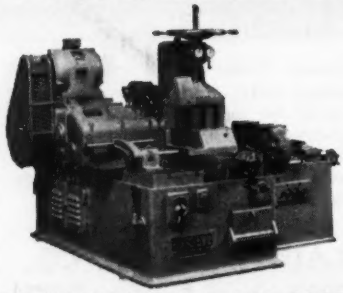

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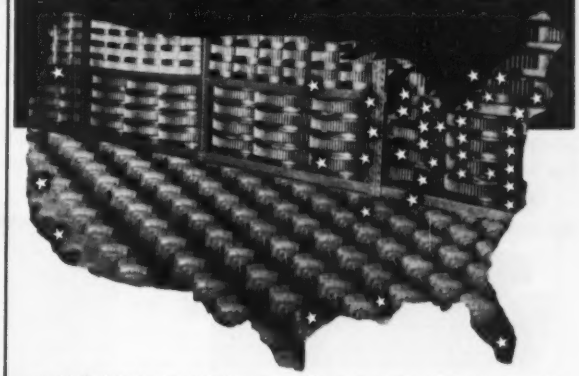

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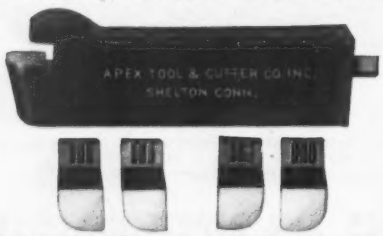

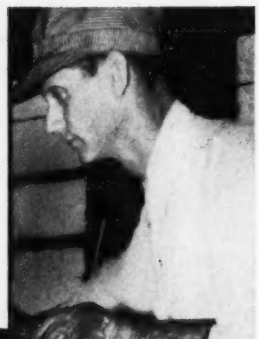

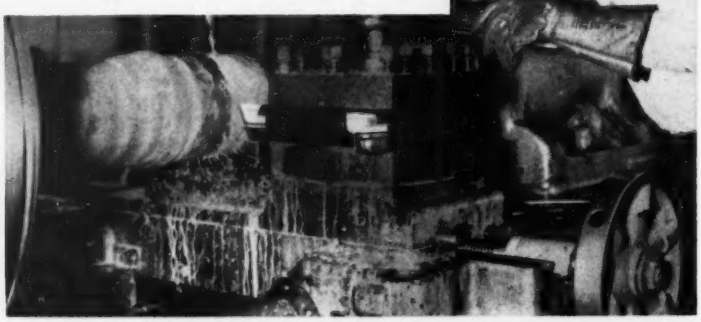

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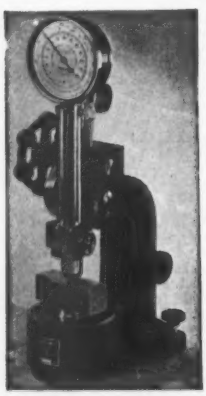

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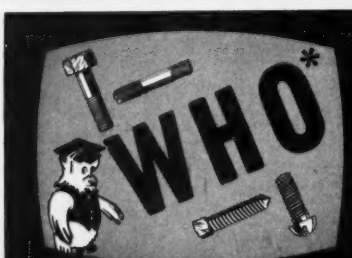

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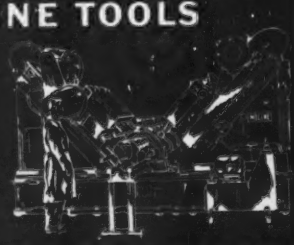

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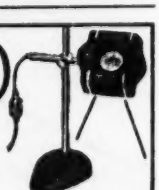

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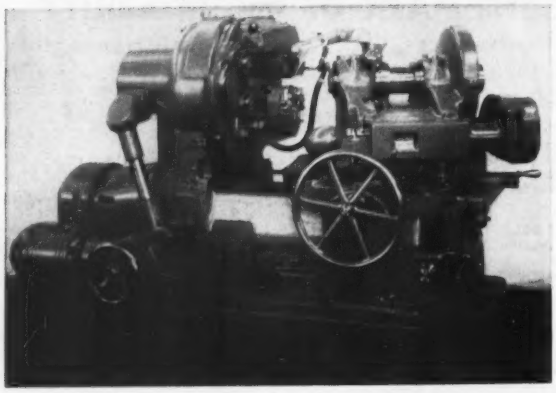

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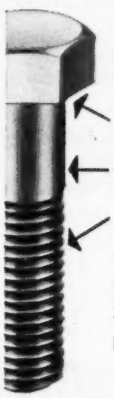

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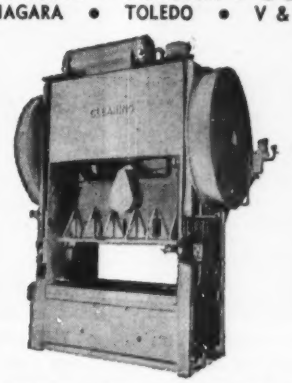

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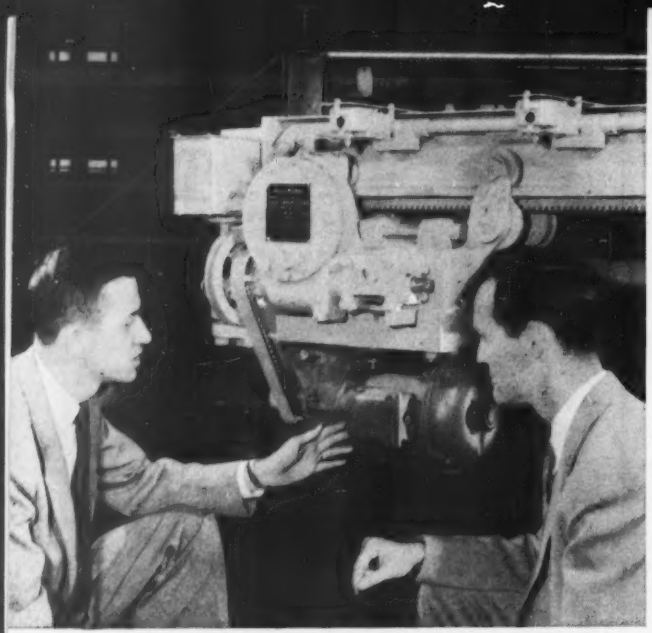

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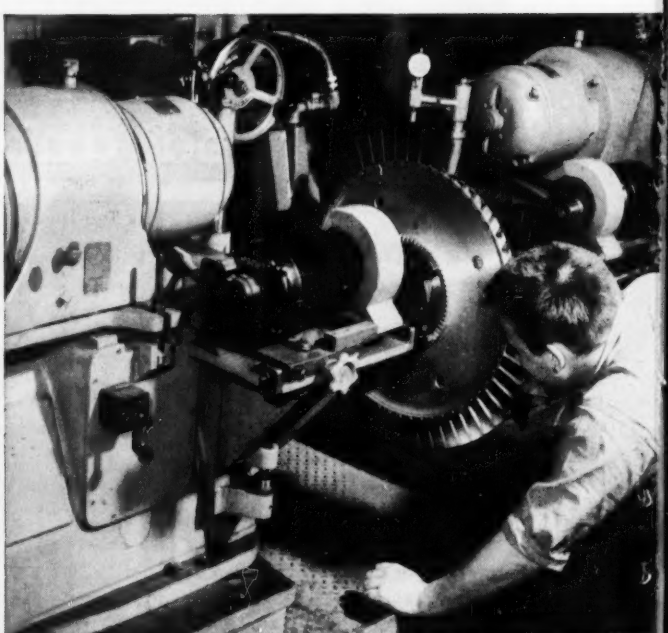

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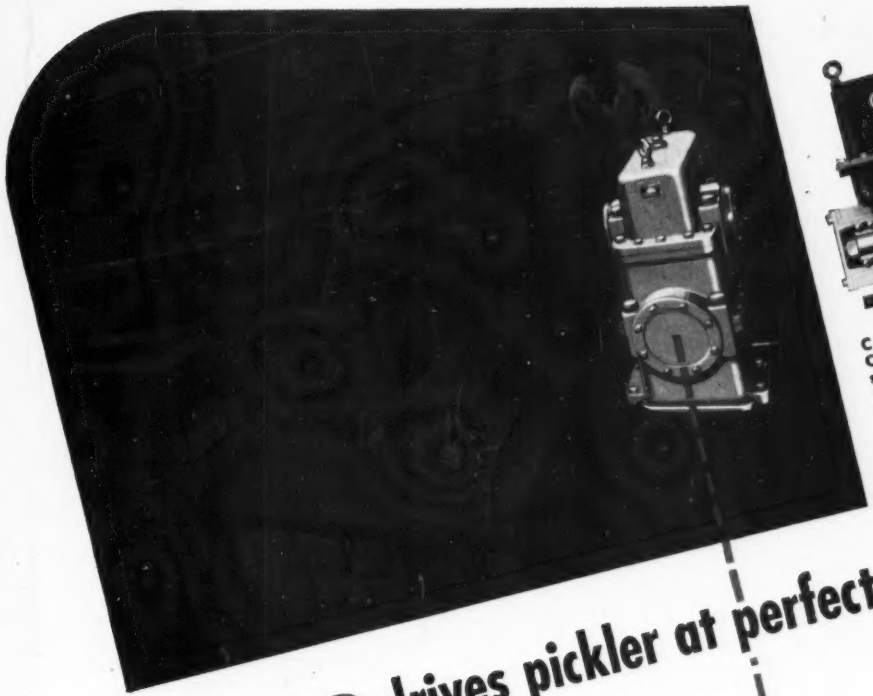

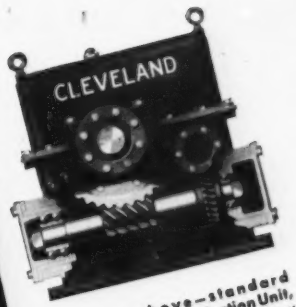

Cutaway above—standard Cleveland Double Reduction Unit, showing high speed and low speed gear assemblies. Cleveland double reduction units available in special designs engineered to serve other slow speed needs. Left — courtesy Precision Drawn Steel Co., Camden, N. J.

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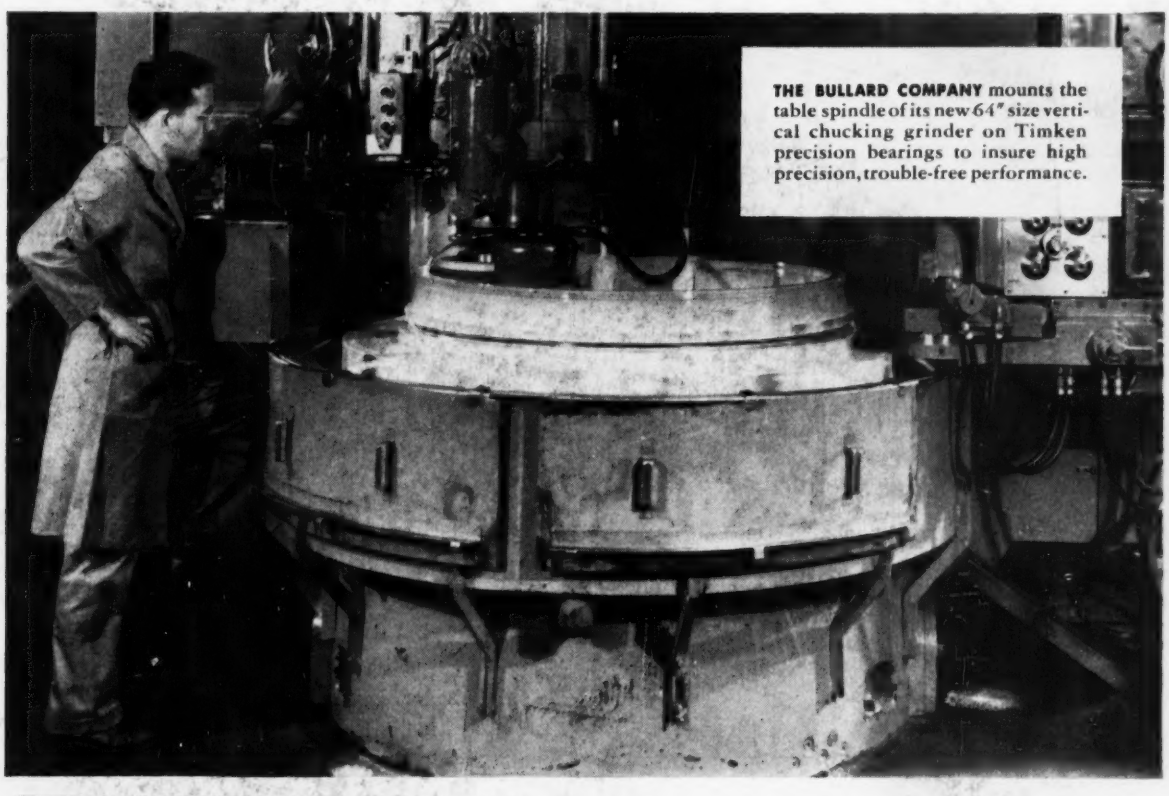

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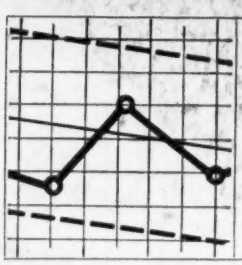

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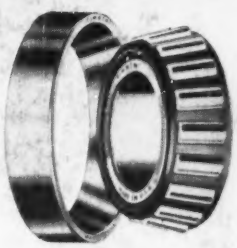

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